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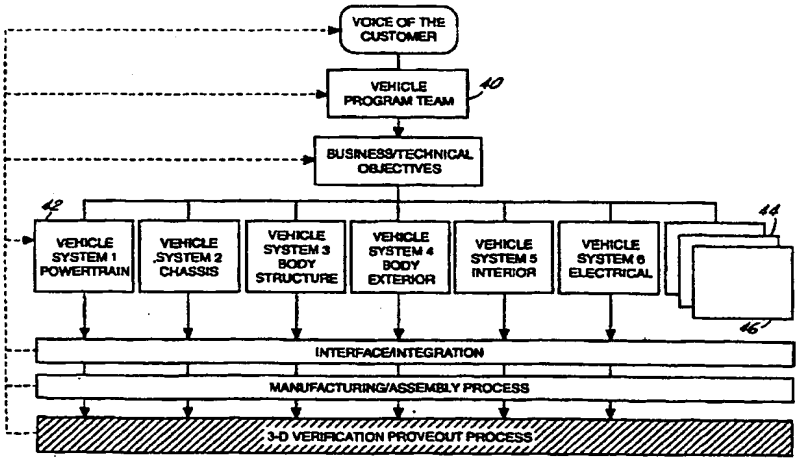

(57) Abstract

A design and engineering project management system (50) comprising a computer including a microprocessor (52), program memory (54), data storage memory (56), one or more displays (64), logic (58) for identifying overall product objectives and group objectives relating to each of one or more subsystems or components of the overall product and displaying the overall objective and group objectives in a plurality of graphic windows which are quickly retrieved by the system operator, thereby integrating the diverse interests and activities of the groups into a comprehensive system design and implementation program. The system (50) also preferably includes logic for identifying one or more strategies for achieving group objectives and presenting the strategies in a graphic form which allows for quick comparison of competing strategies. The system (50) also preferably includes logic for quantitatively measuring progress toward each group's stated objectives and providing a plurality of graphic displays indicating each group's, and the entire project's toward its objectives.

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DESIGN AND ENGINEERING PROJECT MANAGEMENT SYSTEM

Technical Field

The present invention relates to design and engineering project management systems and, more particularly, to a computerized system for the integrated planning and implementation of a multi-component product design and engineering project.

Background Art

The design and engineering of a multi-component product, such as an automobile, typically involves the simultaneous product development activities of many, often technically diverse, business groups. Such projects are often marked by failure to meet various project objectives, such as production costs and time schedules, and may result in the design of components which are incompatible with the overall product.

Several factors contribute to the failure to meet overall product design and production objectives in a multi-component product manufacturing project. A product design and engineering project for complex products such as an automobile is typically subdivided among separate operating groups, often separate business entities, each of which has responsibility for one or more components (or subsystems) of the product. For example, one group may be responsible for the design and engineering of the powertrain components of a vehicle, another group for the electrical system, another group for the body structure, another for the interior, another for the exterior, another group for the chassis, etc.

While some overall vehicle, subsystem, and component objectives may be established at the onset of the project, each of the groups often completes the design and/or engineering of their subsystem by changing or sacrificing one or more of their objectives, or changing the design or process of production for their subsystem, without communicating the changes to the other groups or to those responsible for the completed product. While these changes may be acceptable to the group responsible for the particular subsystem, the effect of these changes on other related subsystems, and a cumulative impact of changes on the overall product is often not appreciated or considered until late in the project.

Variation in the objectives and/or strategies of a particular group during the project may also affect the ability of another group to reach its objectives. For example, a slight, but non-critical change in the design of a sidewall trim component might be implemented without jeopardizing any of the objectives for that component. However, that change may create a fatal incompatibility with the instrument panel component of the same vehicle. Thus, the failure to timely communicate changes in design and/or implementation by the individual groups can have a ripple affect on the other groups which, if discovered too late in the project, can contribute to the failure of one or more of the groups in meeting their objectives.

Similarly, while a cost overrun, an increase in component weight, or a subtle change in design of a particular component may result in a particular group meeting the majority of their stated objectives within an acceptable variance, the cumulative affect of these

variances may result in an unexpected failure to meet overall vehicle objectives. For example, each group might meet all of its objectives except for cost, resulting in an unacceptable overrun on the entire project. Alternatively, if enough groups exceed their weight objectives, though by a relatively small amount, the cumulative affect may be a vehicle that is significantly, and unacceptably, overweight.

These problems, inherent in the production of a multi-component product, underscore a need for clearly defined system and component objectives that meet the overall vehicle definition at the onset.

There is also a need to identify the diverse but interrelated interests and goals of each of the separate operating groups and/or business entities involved in the project.

There is also a need to monitor and assess performance in relation to each group's stated objectives during the project.

There is also a need for facilitating communication between the separate groups at all times during the project so the impact of changes in one group's strategy and/or objectives on any other group can be identified early in the process.

There is also a need for communication by each of the groups to the overall product management level of variances in the objectives and/or strategies implemented by the groups, so that the impact of such variations on the overall product can be quickly identified and assessed.

Finally, there is a need for a comprehensive integrated management system which identifies and tracks overall and individual group objectives and strategies for meeting those objectives, and which evaluates each group's progress, and the effects of that progress and/or any variances in the group's strategies or objectives on the other groups, and on the overall project, on an ongoing basis.

Summary Of The Invention

One object of the present invention is to provide a design and engineering project planning and management system which ensures an integrated and coordinated implementation of a multi-component design and engineering project.

Another object of the present invention is to provide a system for integrated planning and implementation of a multi-component design and engineering project which identifies a clearly defined overall product definition and objectives.

It is another object of the present invention to provide a multi-component project management system which identifies clearly defined objectives for each of the subsystems and components of the overall product.

Yet another object of the present invention is to provide a project management system which identifies one or more strategies which may be implemented to achieve the objectives identified for each subsystem and/or component of the overall product.

Still another object of the present invention is to provide a project management system which provides ongoing monitoring and evaluation of the performance of each of the groups responsible for subsystems and/or components so that potential problem areas can be quickly identified and avoided.

It is yet another object of the present invention to provide a project management system having a user interface which provides quick and easy access to project evaluations and project data at varying levels of detail for the entire vehicle, the individual vehicle systems, subsystems, and components.

It is yet another object of the present invention to provide a project management system which identifies the interrelation of one subsystem and/or component to the other and which quickly communicates changes of one group's project objectives and/or strategies to affected groups to minimize any problems created thereby.

Yet another object of the present invention is to provide a project management system which provides a standardized process for simultaneous product development by each of the groups responsible for development of one or more subsystems and/or components of that product.

A still further object of the present invention is to provide a project management system which integrates diverse interests and groups into a comprehensive system design and implementation program to yield a finished product which satisfies the overall product objectives and meets the product definition.

According to the present invention, a system for planning and managing a multi-component product design and engineering project is provided. The system includes a computer having a microprocessor, program memory, data storage memory, one or more displays, logic for identifying overall product objectives and means for displaying each of the objectives, logic for identifying group objectives relating to each of one or more subsystems or components of the overall product, and means for displaying each of these group objectives, logic for identifying one or more strategies for achieving the group objectives, and means for displaying each of the strategies, logic for monitoring the performance of each group during the project by measuring progress toward that group's stated objectives, and means for displaying a graphical indication of each group's progress toward its objectives.

The system of the present invention also preferably includes logic for evaluating the alternative strategies defined for a group and comparing the current progress of the alternative strategy towards the stated objectives with the current progress of the chosen strategy, and means for displaying a graphical indication of the current status of each of the competing alternative strategies for a group.

The system of the present invention also preferably includes logic for tracking those components or factors in one group's strategy which affect another group's strategy, and communicating any variance in the status of each group's objectives to other groups affected by such variances. This system also preferably includes logic for weighing each of the predefined factors for each strategy on an ongoing basis and

determining when an alternative strategy is preferable, and means for graphically indicating the new optimal strategy for each group necessitated by that group or another group's changing objectives during the project implementation.

The above objects and other objects, features, and advantages of the present invention are readily apparent from the following detailed description of the best mode for carrying out the invention when taken in connection with the accompanying drawings.

Brief Description Of The Drawings

FIGURE 1 is a conceptual diagram illustrating the information flow in a typical organizational structure for a design/engineering project using the project management system of the present invention;

FIGURE 2 is a diagram showing a more detailed organizational structure for a typical design/engineering project;

FIGURE 3 is a schematic representation of the project management system of the present invention;

FIGURE 4 is a vehicle objectives window;

FIGURE 5 is a system objectives window;

FIGURE 6 is a component objectives window;

FIGURE 7 is an alternative component display;

FIGURE 8 is a system build strategies window;

FIGURE 9 is a subsystem build strategies evaluation window;

FIGURE 10 is a system interface/integration objectives window;

FIGURE 11 is a subsystem assembly interface window;

FIGURE 12 is a components interface detail window;

FIGURE 13 is a system interface/matrix;

FIGURE 14 is a vehicle summary window;

FIGURE 15 is a chassis system summary window;

FIGURE 16 is a HVAC system summary window;

FIGURE 17 is a powertrain system summary window;

FIGURE 18 is an interior system summary window;

FIGURE 19 is an exterior system summary window;

FIGURE 20 is an electrical system summary window;

FIGURE 21 is a body-in-white system summary window;

FIGURE 22 is a system variable costs detail window;

FIGURE 23 is a system investment detail window;

FIGURE 24 is a system timing window;

FIGURE 25 is a system mass detail window;

FIGURE 26 is an example of graphical data illustrating projected variable costs for the body-in-white group for a selected period of the project;

FIGURE 27 is an assembly process window;

FIGURE 28 is an objectives status sub-window;

FIGURE 29 is a supplier selection window;

FIGURE 30 is an alternative vehicle summary window;

FIGURE 31 is another alternative embodiment of a vehicle summary window;

FIGURE 32 is a multi-display embodiment of the present invention showing a plurality of system windows;

FIGURE 33 is a multi-display embodiment of the present invention showing subsystem windows; and

FIGURE 34 is a multi-display embodiment of the present invention showing component windows.

Best Mode For Carrying Out The Invention

Referring to Figure 1, the project management system of the present invention is a computer-based project information management tool useful in the design and engineering of multi-component products, such as automotive vehicles. The structure of an organization involved in the design and engineering of a multi-component product, such as a vehicle, is characterized by separate groups or teams, often from different disciplines, and with responsibilities ranging from the design and engineering of the entire vehicle to the design and engineering of a single one of its thousands of parts.

The management system of the present invention provides an environment in which the team responsible for the entire vehicle, the vehicle program team 40, as well as each of the vehicle system teams 42, subsystem teams 44, and component teams 46 can define, quantify, and prioritize vehicle, system, subsystem and component objectives, as well as monitor the status of each team's progress toward these objectives during the project in an integrated fashion.

The system of the present provides an interface which allows for the quick and easy access of project information, ranging from high level, total vehicle status information to details, such as current expected variable costs for particular components. This information is organized and presented by the system in such a manner that all project teams are able to obtain continual, integrated feedback of the progress of the project at all levels.

As shown in greater detail in Figure 2, the management structure for a vehicle design/engineering program typically includes a vehicle program team 40 having members representing all of the diverse business and technical disciplines involved in the design, engineering, manufacturing, production and sale of the product. These program stake holders are preferably all involved in defining the project objective at the total vehicle level.

In the product example shown, the next layer of project management typically comprises a plurality of vehicle system groups 42, such as the powertrain, chassis, body structure and exterior, interior, and electrical groups. The next layer of the project organization which is typically integrated into the project management system are the subsystem groups 44, referred to as product development teams (PDT's). These groups have responsibility for system subassemblies within the different vehicle system teams 42. The next layer of organization typically comprises component assembly teams 46 which are responsible for the design and engineering of the component assemblies which are integrated by the project development teams into the system subassemblies. Another lower level product management team, the component team 48, may have responsibility for the design and engineering of individual components.

It will be appreciated by those skilled in the art that, depending on the type and complexity of the product, a design and engineering project supported by the system of the present invention may have greater or fewer organizational sub-levels depending on the number and complexity of the components which make up the

product. Regardless of the size of the organizational structure, the project management system of the present invention provides a tool for organizing a consistent, integrated, and objective product, subassembly, and component definition. In addition, the interface provided by the system allows for integrated monitoring and tracking during the execution of the project at all levels of the organization, thereby providing the opportunity for implementing and optimizing product strategy.

Referring now to Figure 3, the project management system of the present invention, generally referred to as 50, includes a computer having one or more microprocessors 52, program memory 54, storage memory 56, program logic 58, at least one data input means such as a keyboard 60 and/or a mouse 62, and one or more displays 64,66. The system includes logic for identifying overall project objectives and means for displaying each of these objectives, logic for identifying group objectives relating to each of one or more subsystems or components of the overall product and means for displaying each of these group objectives, logic for identifying one or more strategies for achieving group objectives and means for displaying each of the strategies, and logic for monitoring the performance of each group during the project by recording progress toward that group's stated objectives and displaying each group's progress in a graphical form.

The system may also include a scanner (not shown) for scanning in graphics for use in the system's displays.

The system also preferably includes logic for simultaneously monitoring any alternative strategies, evaluating those strategies and displaying the evaluation factors and results for the alternative strategies to facilitate quick examination of project progress and suggest selection of the optimal strategy for achieving the project objectives.

The system also preferably includes logic for identifying system-to-system and component-to-component interrelationships, monitoring the change in status of the interfaces, evaluating the affect of any change in the interfaces based upon predefined factors, and displaying the evaluation factors and results for each interface.

In one embodiment, the system is implemented on a conventional personal computer having a Motorola 80486 microprocessor (or functional equivalent) utilizing a conventional spreadsheet program, such as Quatro Pro® by Borland, in a Microsoft Windows® operating environment. It is contemplated, however, that more complex implementations of the system for a product including, for example, thousands of component parts, and with many objectives, alternative strategies, and many system-to-system and component-to-component interfaces, would be implemented on a larger computer having 100 megabytes or more of storage memory, a plurality of displays, and wherein the logic is implemented using a more versatile programming language such as C, CH, or Fortran. It is also contemplated that the system may utilize and/or incorporate other project management software such as, for example, Viewpoint®, to perform some of the system functions described herein,

or to provide adjunct functions consistent with the project management objectives of this system.

The display means for the system of the present invention preferably includes multiple windows which may be easily selected, resized, and/or moved to provide quick and easy access to project information at all the various levels of detail. In one embodiment, the interface is implemented in the Microsoft Windows® environment. These windows may be called by a predetermined keystroke for display on a single CRT display 64, or may be displayed on one of a plurality displays (shown as displays 64 and 66 in Figure 3 or as displays 150 in Figures 32-34) to facilitate the rapid desemination of project information to the system operator.

The system 50 of the present invention preferably provides a plurality of "Objectives" windows which, when activated by the operator, allow for input, and subsequent review, of project objectives, display the targets established for those objectives, and an indication of the current status regarding that objective.

The Vehicle Objectives window 68 of Figure 4 illustrates some typical objectives which might be defined by the project stakeholders at the vehicle team level. Typical business objectives include variable costs, investment costs and assembly hours targets. Typical technical objectives include a total vehicle mass, fuel economy, reliability, quality, assembly processing and tooling costs and manufacturing processing and tooling costs targets.

It should be noted that the units for measuring progress toward the objectives may vary according to

the nature of the objective. For example, cost objectives would typically be quantified in dollars, vehicle mass in pounds, fuel economy in miles per gallon, and timing objectives in any one of the generally accepted units of time, such as weeks, months, man-weeks or man-months. Other traditionally non-quantitative objectives such as quality or reliability might be measured in arbitrary units established and defined by the project teams. However these objectives are measured, it is preferable that the same units be used by each of the teams to allow for easy integration of the data at and across all levels of the project.

In addition to defining objectives and quantifying targets for the objectives, the system preferably allows for a weighting or prioritization of the individual objectives. This may be illustrated on the Vehicle Objectives window 68, for example, merely by the order in which the objectives appear on the list, or by color-coding the objective to indicate the relative importance to the project.

Figure 5 illustrates another objectives window, the System Objectives window 70. The system 50 preferably includes a plurality of System Objectives windows 70, corresponding to each of the system teams included in the project, such as, for example, power-train, chassis, body, interior, electrical, etc. As with the Vehicle Objectives window 68, each System Objectives window 70 includes the common objectives established by the vehicle team stakeholders, the targets established for those objectives for the particular system team, and the status of the system team's progress toward meeting the objectives.

It preferably includes additional objectives establishing a more detailed criteria for meeting the more general vehicle objectives. For example, the interior systems group might establish noise level and ergonomics objectives and targets (shown at 72) which form additional objective criteria for assessing the overall quality objectives for the system team. Similarly, an additional level of more detailed objectives (shown at 74) such as front seat leg room, shoulder room, etc. might be established as further quantitative criteria defining the ergonomics objective.

Figure 6 illustrates a Component Objectives window 74. The system 50 typically includes a plurality of Component Objectives windows corresponding to each of the component teams of the project. Again, the window would illustrate all of the objectives which are common to that component team's system team and the vehicle team, as well as additional objectives establishing more detailed criteria for those common objectives.

It will be appreciated by those skilled in the art that additional objective windows would typically be provided for each of the teams at each of the levels in the project structure. For example, in the vehicle project illustrated in Figure 2, the system 50 would include a series of subsystem objectives windows (not shown), each corresponding to the product development team comprising the subsystem groups 44. As will also be appreciated by those skilled in the art, the objectives windows 68, 70 and 74 of the present invention allow project personnel utilizing the system 50 to review the targets and status of the project quickly and easily, and at selected levels of detail by simply switching from window to window. The establishment of

common objectives and criteria for measuring progress toward the associated targets for those objectives provides a comprehensive, integrated view of the status of the project.

Figure 7 illustrates a component display 76 which may be provided by the system 50 of the present invention to indicate some or all of the components in a particular component group, along with the associated component objectives. This display preferably consists of a view (usually a perspective view) of the particular component 78 accompanied by a reduced-sized component objectives display 80 associated with that component. This display provides the operator with information relating to objectives and the current status is attaining those objectives, for each component. As an alternative, or in addition to, the component display shown in Figure 7, an alternative components display (not shown) may be provided by the system 50 which, in the format shown in Figure 7, displays a view of each of the alternative designs for one particular component along with the component objectives for each of the alternative designs. In addition to quickly determining the status for that component, the operator could also then view the alternative designs and objectives which might be considered in the event a particular component proves unacceptable.

Referring now to Figure 8, the system 50 may also provide a system Build Strategies window 82, which identifies the currently "selected" build strategy for a product, as well as any alternative strategies and/or rejected strategies developed for the product. The System Build Strategies window 82 typically includes a plurality of sub-windows, each corresponding to a step

in the assembly sequence or a sub-assembly at each of a plurality of assembly stations. The hypothetical product shown in Figure 8 illustrates various generic sub-assemblies such as the assembly of the base portion of the product (Step 1), integrating the major operating portion of the product with the base (at Step 2), and assembly of an exterior shell structure with the operating portion and base portion of the product (Steps 3-6). The Build Stragegies window could also be subdivided by project group (such as each vehicle systems group) with each column representing that project group's portion of the product assembly.

Figure 8 illustrates the current selected build strategy for the imaginary product at the top row of the window with sub-windows 84-94 showing six major assembly steps. In addition, alternative build strategies and/or assembly sequences are illustrated in the additional sub-windows 96. Alternative Build Strategies for sequences for components can also be shown in intermediate fashion, such as the pre-assembly of various top outer shell components shown in sub-window 95. In this manner, a different manner or sequence of assembly of components can be displayed for consideration. Rejected build strategies may also be illustrated, as shown in sub-windows 98.

As shown in Figure 8, each of the individual component assembly strategies may be represented by a unique graphic icon associated with the strategy. Alternatively, the sub-windows 84-98 for each of the strategies could be a miniature representation of the System Objectives window corresponding to that strategy. Further information about each strategy may be quickly obtained by clicking on the sub-window corresponding to

the selected strategy. This further information could be in the form of a full-sized objectives window corresponding to the selected build strategy. In the alternative, the Subsystem Build strategies window for the selected build strategy could be displayed.

It will be appreciated by those skilled in the art that a plurality of Build Strategies windows may be provided, corresponding to each group level of a project, such as subsystems and component assemblies. These build strategy displays may be integrated as described above, thereby allowing an operator to view, for example, the current build strategy for the vehicle, click-on the interior system to view the current build strategy for each of the subsystems which comprise the interior, and again click-on one of the subsystem build strategies to view, for example, the current build strategy for the instrument panel. Again, in a matter of clicks or keystrokes, a system operator can view the current and alternative build strategies, as well as the status of each of the group's implementing those strategies at every level of detail in the project. In addition, the operator can view the objectives displays corresponding to various alternative build strategies to determine whether, for example, the targets for alternative strategies might indicate adoption of that strategy as the newly selected strategy in light of the current status of the project.

Referring to Figure 9, the system 50 of the present invention also preferably includes Subsystem Build Strategies Evaluation windows 100. As with the system builds strategies window 82, the subsystem strategies evaluation window 100 includes graphic

indicia 102-106 of each of the alternative subsystems in a particular group.

In the example shown in Figure 9, three alternative front bumper assemblies are shown graphically in sub-windows 102-106. These graphic indicia of the alternative assemblies may be in the form of simplified exploded perspective views of the assemblies or in other iconic forms which suitably differentiate between the alternatives. Associated with each alternative assembly are objective comparison graphs 108-124 which graphically indicate the current status of each objective relative to the target. For example, sub-window 108 illustrates a variable cost graph for alternative number one indicating a targeted variable cost at $70.00 for the assembly, at 126, and a currently estimated variable cost of between $100 and $120.00.

The graphic indication of the current status of the variable cost in sub-window 108 is preferably color-coded, for example in red, to indicate that it is unacceptably high. Thus, it will be appreciated by those skilled in the art that the variable costs for each of the alternative assemblies shown in sub-windows 102-106 can be quickly compared by viewing sub-windows 108-112.

In the example shown in Figure 9, alternative three appears to be the current optimal alternative on the basis of variable cost. Some or all of the other objectives may be compared in graphical form in a like manner, such as are shown in the investment costs sub-windows 114-118 and mass sub-windows 120-124. It will be appreciated by those skilled in the art that, where many objective sub-windows are displayed, each sub-

window can be displayed in a downsized, iconic representation which can be "zoomed" to a readable size by pointing and clicking the mouse on the desired sub-window (or by other predefined keystrokes). Similarly, a subset of the sub-windows, such as each of the variable cost windows for each of the alternative subassemblies displayed, may simultaneously be enlarged to provide for quick comparison of a common objective among the competing strategies.

Another type of display provided by the system 50 of the present invention is the Interface/Integration Objectives window 126. As with the other objectives displays 68, 70 and 74, the system preferably provides a plurality of Interface Integration Objectives windows corresponding to interface/integration objectives at each level of the project. For example, Figure 10 illustrates a Systems Interface Integration Objectives window. This display might identify fit and finish interface objectives for the exterior system team. These interface objectives typically include physical interface tolerance objectives, functional integration, and timing objectives. The identification of interfaces, particularly across groups, is critical to overall project integration. For example, merely identifying the fit objective for an instrument panel in the Interface/Integration Objectives window for the side panel subsystem team allows for integration of the instrument panel subsystem team's objectives with the side panel subsystem team. Likewise, identifying an interface objective in the instrument panel subsystem team that the side wall have a critical dimension at the potential physical interface of the side wall with the instrument panel, identifies a potential design incompatibility

which otherwise might not be discovered by the instrument panel subsystem team.

Figure 11 is a Subsystem Assembly Interface window 128. This window provides a comprehensive display of the interface for a particular subassembly depicted in window 130, and a plurality of components interface detail windows 132, each of which displays detail information relating to a particular interface point in the subassembly shown in window 130. The component interface detail windows 132 may be enlarged, preferably by locating the mouse indicator and clicking on the desired window, to clearly display the interface objectives to the operator. An enlarged component interface detail window 132 is illustrated in Figure 12.

Referring to Figure 13, the system 50 may provide a system/Zone Interface Matrix window 134 which graphically displays the interrelationship of the system (or subsystem) teams. By utilizing a color-coded matrix, the system 50 can remind the operator that, at 136, there is a significant interrelationship between subsystem team B of the electrical system team (e.g. electronic control modules group), and subsystem team A of the powertrain system (e.g. the emission control system group). By accessing the appropriate interface/integration objectives display for those groups, a project team member can then quickly identify how the two subsystems are interrelated and what effect the current status of the interrelated objectives might have on each of the groups.

In an alternative embodiment, logic can be provided to determine the current status of, for example, each objective of a particular subsystem which

potentially affects the objective of another subsystem and, on the basis of predefined criteria interrelating these objectives, produce a vehicle system/zone interface matrix which is color-coded to indicate the current status of the interface. For example, the system could track the critical physical dimensions of the currently selected instrument panel design and compare that critical dimension with the corresponding critical dimension of the currently selected door trim design and, if the dimensions exceed a predefined threshold, indicate the potential physical incompatibility by displaying that block in the matrix corresponding to the interface of those two subsystems teams in red. If the comparison indicates no physical incompatibility, the corresponding block on the interface matrix would be displayed in green. If the critical dimensions are within some predefined range, the interface matrix might display the corresponding block as yellow. Thus, a potential interface problem can be quickly identified, even where the status of each of the group's project indicates that their own objectives are on target.

Referring now to Figure 14, the system 50 preferably also includes a System Summary window 138 which allows the operator to discover the status of each of the vehicle systems' progress toward meeting their respective objectives. In the System Summary window 138 shown, the vehicle objectives are listed on the vertical axis 140, and each of the vehicle systems are listed on the horizontal axis 142, defining a matrix into which graphic indicia of the status of each system's progress toward each objective is displayed. In the display of Figure 14, the graphic indicia are simply one of three color dots, with a red dot indicating that that particular system is not currently on track to meet that

particular objective. The yellow dot indicates that obtaining the objective is in doubt, while a green dot indicates that the respective system group is currently expected to meet their respective objectives.

It will be appreciated by those skilled in the art that various different criteria can be utilized to establish whether a particular group is failing, in doubt, or succeeding in meeting its objectives. For example, the status indicator at 144 reflects that the chassis team is currently on track to meet their mass objectives. The criteria for a green status might be that the total expected chassis mass is less than the target. For example, each of the chassis subsystems (displayed in Figure 15) current expected mass is less than their respective targets, yielding a green status for chassis system mass. Another alternative criteria might be a weighted percentage of each of the subsystems, or a user-defined series of ranges of variance from the target, with, for example, green status indicating that all subsystems are within 10% of their target mass, yellow status indicating that all subsystems are within 15%, and red status indicating that one (or more as defined) of the subsystems is greater than 20% in excess of its mass target.

It will also be appreciated by those skilled in the art that various algorithms can be developed for each objective for determining the status of that objective. Indeed, the system 50 allows for the user to define the criteria and/or create algorithms for determining the status of these objectives, thereby providing a significant degree of flexibility in tailoring the application of the system to the particular project with which it is utilized. Once

defined, the System Summary window provides a simple yet comprehensive picture of the status of the entire system.

The system 50 can also be adapted to provide instant access to more detailed displays from the System Summary window 138. For example, by clicking on any one of the system labels on the horizontal axis 142, the corresponding Sub-system Summary window (illustrated in Figures 15-21) could be displayed. Similarly, the system can be provided with the capability of generating, for example, one of the System Details windows (shown in Figures 22-25) whenever the operator clicks on the dot corresponding to that particular objective and system in the System Summary window 138.

The system 50 also preferably provides a plurality of status displays for each of the individual vehicle sub-systems, such as the Chassis Summary window 146 illustrated in Figure 15. In the embodiment shown, the Chassis Summary window 146 identifies each of the system (and/or sub-system) objectives on the vertical axis and the total chassis system and chassis subsystems on the horizontal axis. In this display, the actual current status of each objective is displayed in green where the subsystem or system is on target to meet that objective, and a -1 is displayed in red where the chassis system or one of its subsystems is not currently expected to meet its respective target for that objective. It will be appreciated by those skilled in the art that the system 50 might alternatively display actual values, color-coded, or with some other graphic indicia of the progress (or lack of progress) toward meeting each objective.

The Chassis Summary window 146 of Figure 15, as well as the HVAC Summary window 148, Powertrain 150, Interior 152, Exterior 154, Electrical 156, and Body-in-White 158 of Figures 16-21, provide the system operator with an additional level of detail for each of the vehicle systems and their subsystems along with a summary indication of the current status for each of the subsystems.

It will be appreciated by those skilled in the art that, the System Summary window of Figure 14, and each of the sub-system Summary windows of Figures 15-21 can be modified to provide various additional information, or to provide the same information using different graphical indicia of the progress of each of the groups toward attaining their objectives. Also, depending on the size of the project, summary displays may also be generated by the system 50 for each of the component level groups. In this manner, the operator can quickly review the current status of the project at all levels.

Referring now to Figures 22-25, an additional level of project detail may be provided in detail displays such as, for example, the Variable Cost Detail window 160, Investment Detail window 162, Timing window 164, and Mass Detail window 166.

In the Variable Costs Detail window 160 shown in Figure 22, a spread sheet of a series of estimates and variable costs for the entire vehicle and each of its systems at various stages of the product is provided, along with the targets and the total variable costs estimated at various stages in the project. This detail sheet can be used to gauge trends as well as to ascer-

tain the current variable cost information for the project.

It will be appreciated by those skilled in the art that detail windows for each objective may be provided by the system 50, allowing an operator quick access to detailed breakdowns of project data by system, subsystems, and components in a series of mouse clicks or keystrokes.

As shown in Figure 26, the data contained in each of the detail windows 160-166 may also be displayed graphically, as shown for example in the Graphs window 170, providing a snapshot of the trend of a particular group's progress in reaching a particular objective. These graphs might be obtained by clicking on the "graphs" buttons 168 provided in each of the detail displays shown in Figures 21-25, or by any series of predefined keystrokes.

Figures 27 and 28 illustrate a component assembly process window 172 which depicts the assembly process for one or more component assembly groups. Each of the steps in the assembly process is depicted as a sub-window 174-188. The sub-windows are arranged to display the timing of the assembly, with graphic indicia in each of the sub-windows indicating the components involved in each step of the process. An objectives sub-window 190 (shown enlarged in Figure 28) lists the objectives associated with each assembly step along with some graphic indicia of the status of those objectives. As with the other windows generated by the system 50, a mouse click or a series of keystrokes may be utilized to produce additional information relating to any of the components depicted in the sub-windows 174-188.

Referring now to Figure 29, the system 50 may provide a Supplier Summary window 192 which identifies supplier objectives (such as those displayed in the vertical axis) and potential suppliers (displayed in the horizontal axis) forming a matrix including graphic indicia of how each supplier rates in its capability to achieve the defined objectives. In the Supplier Summary window 192 shown, various graphic indicia are utilized. For example, stoplight icons 194 may be utilized to provide simple three-color-coded rating, where green indicates acceptability, yellow indicates doubtful capability, and red indicates a lack of capability. Color-coded bar graphs 196 and color-coded line graphs 198 may also be utilized to provide simple graphic indication of each supplier's capability, allowing for quick comparison of suppliers. Again, as with other summary windows, additional detail may be displayed by the system in response to clicking on a selected sub-window (194-198) or in response to other predefined keystrokes.

Figure 30 illustrates an alternative Vehicle Summary window 200 wherein graphical icons are utilized to identify the vehicle systems. Again, it will be appreciated by those skilled in the art that various forms of the displays may be utilized without departing from the spirit of the invention.

Referring now to Figure 31, an alternative form of Vehicle Summary window 202 may be generated by the system 50 which utilizes a series of more detailed graphs 204-212 to indicate the status of each of the systems toward meeting their respective objectives. In the Vehicle Summary window 202 shown, a series of business objectives are indicated along with the vehicle

targets for each of those objectives (at 214). Each of the systems' status is graphically displayed in a series of graphs 204-212 which are preferably color-coded (not shown) to indicate whether the current status meets the objective, is in doubt, or is unacceptable. Again, various criteria can be established for determining whether a particular system satisfies its objectives. Also, as with the other windows supported by the system 50 of the present invention, additional detail may be obtained by the operator by positioning the mouse pointer over, for example, one of the graphs 204-212, or by other predefined keystrokes. It will be appreciated by those skilled in the art that, as with the other summary windows supported by the system 50, the Vehicle Summary window 202 provides an integrated look at each of the systems' progress toward the commonly objectives as well as the cumulative vehicle targets for each of these objectives.

In an alternative large scale, multi-display embodiment of the present invention shown in Figures 32-34, multiple displays containing the various forms of information described and shown in Figures 4-31 on a single wall, thereby allowing one or more operators to view project information at various levels of detail by scanning the plurality of displays rather than by switching between displays on a smaller (e.g. 1 or 2 CRT) display system. In Figure 32, project information is displayed on a plurality of displays 216 which are physically organized by vehicle system groups. In this alternative embodiment of the system 51, the displays in the powertrain group would typically include a Powertrain Objectives display, one or more Build Strategies displays identifying the selected build strategy as well as any alternative strategies, Powertrain Inter-

face/Integration display(s), a Powertrain Summary display, and various Powertrain Detail displays, graphs, and other powertrain group project data. Each of the other systems would similarly include the project information, organized in the manner described above in connection with Figures 4-31, to provide a comprehensive, integrated project data center.

This multi-display arrangement can be repeated at each project group level. For example, a subsystem group display, such as the type shown in Figure 33, and component groups displays, such as shown in Figure 34, could be organized and assembled in the alternative multidisplay system 51 of the present invention in much the same manner as the system displays of Figure 31 to provide increasing levels of detail in a massive multi-user, multidisplay environment.

Thus, the various embodiment of the system of the present invention provide an integrated project management system which allows for the efficient design and engineering of a multicomponent project by providing the vehicle for a coordinated common project definition and project objectives. The system also allows for constant review of the project at all levels of detail to determine where objectives are being met, where failure to meet objectives might affect other groups' progress, and when and where adoption of alternative strategies might advance the project.

While the present invention has been described primarily in the context of its use in a vehicle design project, it clearly has an application in the management of any design, engineering, and/or manufacturing project involving a complex, multi-component product. Indeed,

the management system 50 of the present invention is useful in the management of any project which must integrate business, technical, and graphic data.

While the best mode for carrying out the invention has been described in detail, those familiar with the art to which this invention relates will recognize various alternative designs and embodiments for practicing the invention as defined by the following claims.

What Is Claimed Is:

1. A project management system for use in managing the design and engineering of a multi-component product, the system comprising:

a microprocessor;

program memory;

data input means;

at least one display;

first logic for identifying overall product objectives and displaying each of the product objectives;

second logic for identifying each group responsible for each subset of one or more of the components which make-up the overall product, identifying additional group objectives relating to each of the identified groups, and displaying each of these groups and their respective objectives;

third logic for monitoring the performance of each group during the project by measuring progress toward that group's stated objectives and displaying graphical indicia of each group's progress toward its objectives.

2. The invention of claim 1 wherein the overall product objectives are displayed in a product objectives window which lists each of the objectives, quantitative targets corresponding to each of the objectives, and graphic indicia of the progress toward reaching the objectives.

3. The invention of claim 1 wherein display of the group objectives includes a plurality of group objectives windows, each including a list of the overall product objectives, the quantitative targets for that

group relating to those product objectives, and graphic indicia of the status of that group's progress toward reaching its targets.

4. The invention of claim 1 further including fourth logic for identifying one or more strategies for achieving group objectives and displaying the strategies.

5. The invention of claim 4 wherein the display of each of the strategies includes an alternative build strategies window including graphic indicia of each of the strategies.

6. The invention of claim 4 further including fifth logic for evaluating the strategies based upon predefined factors and displaying selected evaluation factors for each strategy.

7. The invention of claim 6 including logic for generating a build strategies evaluation window having unique graphic indicia corresponding to each of a plurality of displayed alternative build strategies and, for each of the displayed strategies, including graphic indicia relating to the evaluation of at least one of the objectives, whereby the relative merits of the alternative build strategies can be compared.

8. The invention of claim 1 wherein the second logic includes logic for displaying selected components from a selected assembly of components in a component window including graphic indicia of the selected components in the assembly and, associated with each of the graphic indicia, a sub-window identifying the component objectives associated with that component.

9. A design and engineering project management system comprising:

a microprocessor;

memory;

one or more displays;

data input means;

first logic for identifying objectives to be achieved and displaying each of the objectives;

second logic for identifying strategies for achieving the objectives and displaying each of the strategies;

third logic for evaluating the strategies based upon predefined factors and displaying the evaluation factors and results for each strategy; and

fourth logic for selecting and identifying the optimal strategy for achieving the objectives and displaying the optimal strategy.

10. A manufacturing project management system for use in managing the design and production of a multi-component product incorporating a plurality of one or more components which together comprise the product, the system comprising:

a microprocessor;

memory;

one or more displays;

first logic for identifying overall project objectives and means for displaying each of the objectives;

second logic for identifying group objectives relating to each of the groups, and means for displaying each of these group objectives;

third logic for identifying one or more strategies for achieving each of the group objectives, and means for displaying each of the strategies;

fourth logic for evaluating the strategies based upon predefined factors, and means for displaying the evaluation factors for each strategy; and

fifth logic for selecting the strategy for each group which is optimal in achieving the overall product objectives, and means for displaying each of the optimal strategies selected.

11. In an automotive vehicle design and engineering project having a group responsible for the overall project, and a plurality of systems groups, each responsible for design and engineering of a predefined portion of the vehicle, a design and engineering project management system, the system comprising:

a microprocessor;

program memory;

at least one display;

first means for identifying overall vehicle design and engineering objectives and displaying the defined objectives;

second means for identifying system objectives relating to each of the systems groups and displaying each of these systems groups' objectives;

third means for identifying one or more strategies for achieving each of the systems groups' objectives and displaying the strategies;

fourth means for evaluating the strategies based upon predefined factors and displaying the strategies, the evaluation factors, and the results of the evaluations in graphical form; and

fifth means for selecting the strategy for each systems group which is optimal in achieving the overall vehicle objectives and displaying each of the optimal strategies selected.

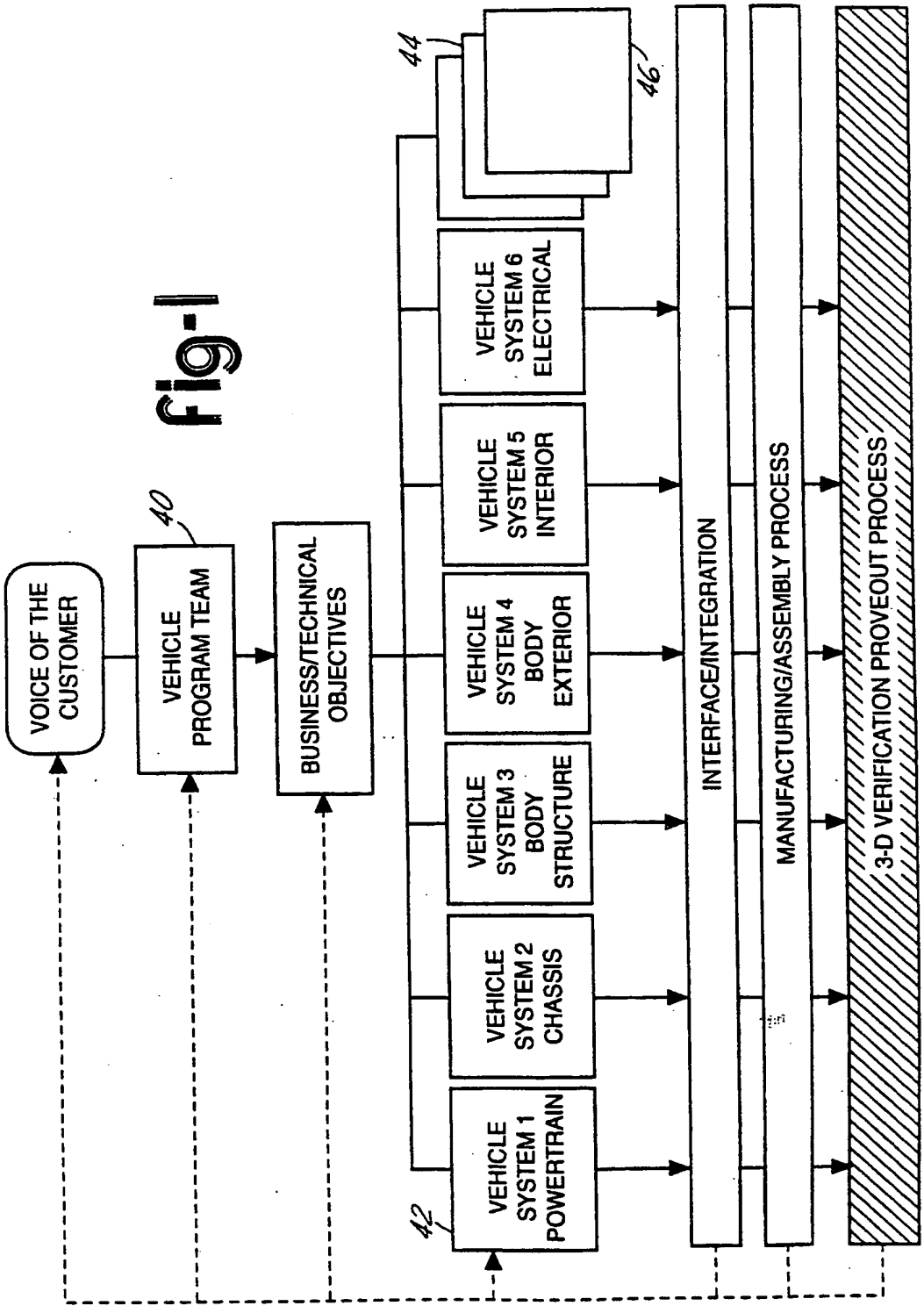

VOICE OF THE CUSTOMER
VEHICLE PROGRAM TEAM
40
BUSINESS/TECHNICAL OBJECTIVES
VEHICLE SYSTEM 1 POWERTRAIN
42
VEHICLE SYSTEM 2 CHASSIS
VEHICLE SYSTEM 3 BODY STRUCTURE
VEHICLE SYSTEM 4 BODY EXTERIOR
VEHICLE SYSTEM 5 INTERIOR
VEHICLE SYSTEM 6 ELECTRICAL
44
46
INTERFACE/INTEGRATION
MANUFACTURING/ASSEMBLY PROCESS
3-D VERIFICATION PROVEOUT PROCESS

fig-1

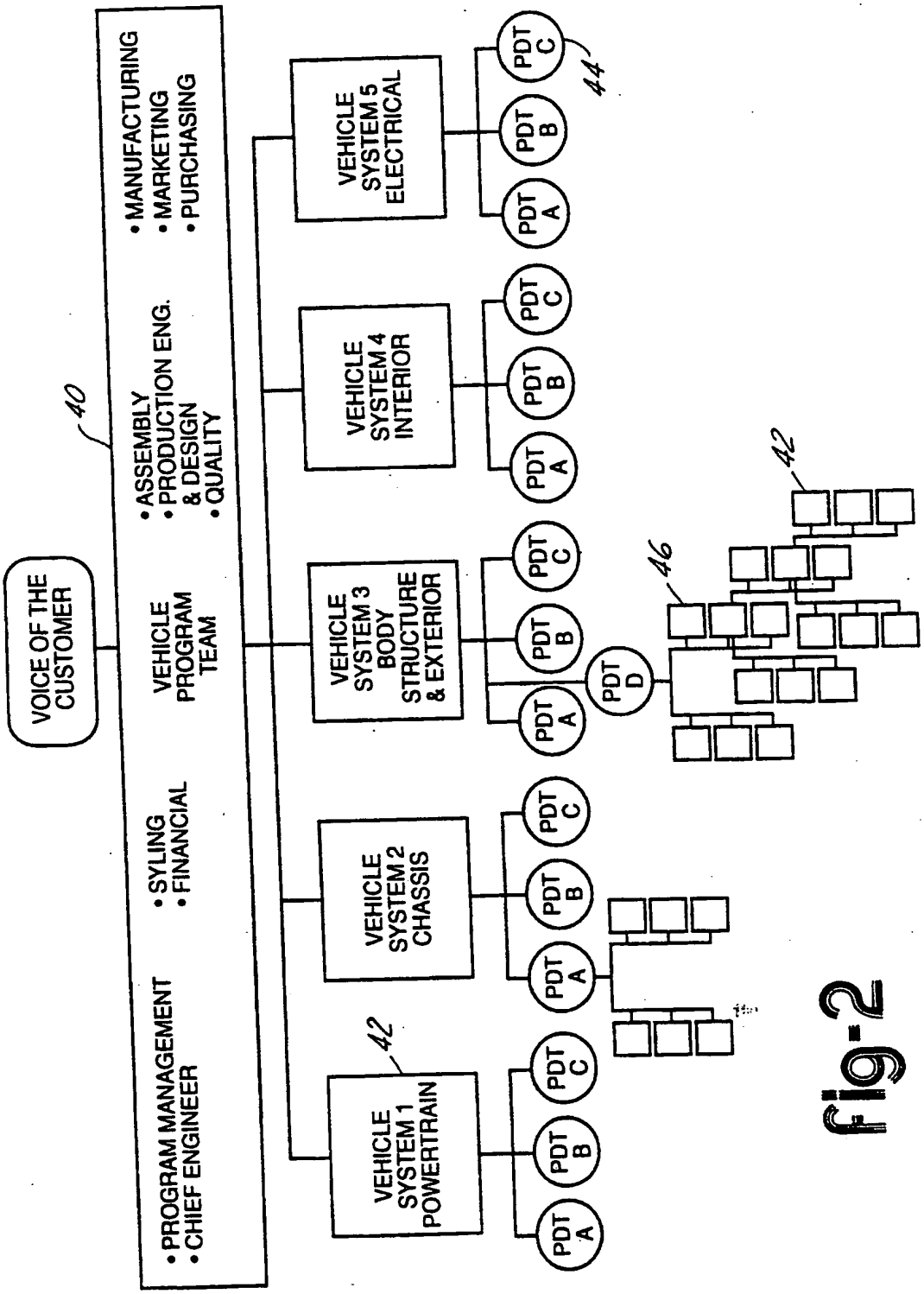

VOICE OF THE CUSTOMER
40
VEHICLE PROGRAM TEAM
• PROGRAM MANAGEMENT
• CHIEF ENGINEER
• SYLING
• FINANCIAL
• ASSEMBLY
• PRODUCTION ENG. & DESIGN
• QUALITY
• MANUFACTURING
• MARKETING
• PURCHASING
VEHICLE SYSTEM 1 POWERTRAIN
VEHICLE SYSTEM 2 CHASSIS
VEHICLE SYSTEM 3 BODY STRUCTURE & EXTERIOR
VEHICLE SYSTEM 4 INTERIOR
VEHICLE SYSTEM 5 ELECTRICAL
PDT A
PDT B
PDT C
PDT D
42
44
46

Fig-2

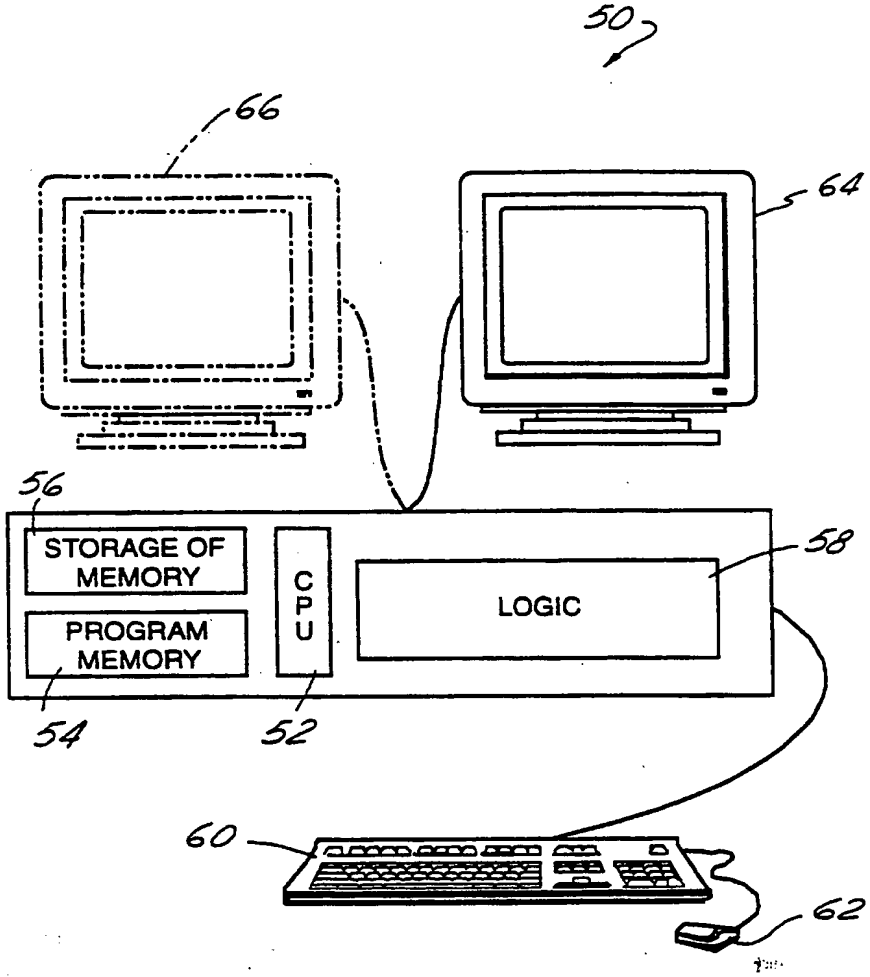

50
66
64
56
STORAGE OF MEMORY
PROGRAM MEMORY
CPU
LOGIC
58
54
52
60
62

Fig-3

VEHICLE OBJECTIVES

DATE:

VEHICLE

MODELS	PLANNING VOLUMES	PLANNING YEAR
SEDAN COUPE UP-LEVEL BASE LEVEL •		

OBJECTIVES	TARGETS	STATUS
BUSINESS VARIABLE COST INSTRUMENT COST ASSEMBLY HOURS • • •		
TECHNICAL MASS FUEL ECONOMY RELIABLITY QUALITY ASM PROCESSING & TOOLING MFG PROCESSING & TOOLING • • •		
TIMING PROGRAM DEFINITION PROGRAM IMPLEMENTATION THEME DECISION PROGRAM CONFIRMATION PROTOTYPE READINESS ENGR/MRG DESIGN SIGN OFF • • •		

68

Fig-4

SYSTEM OBJECTIVES

DATE:

SYSTEM

MODELS	PLANNING VOLUMES	PLANNING YEAR
SEDAN COUPE UP-LEVEL BASE LEVEL •		

OBJECTIVES	TARGETS	STATUS
BUSINESS VARIABLE COST INVESTMENT COST ASSEMBLY HOURS PART COUNT •		
TECHNICAL MASS BODY STIFFNESS BEAMING TORSION NOISE LEVEL — 72 ERGONOMICS FRONT SEAT LEG ROOM REAR SEAT LEG ROOM SHOULDER ROOM HIP ROOM LUGGAGE VOLUME INTERIOR VOLUME — 74 RELIABILITY QUALITY PROCESSING & TOOLING		
TIMING VEHICLE OBJECTIVES SYSTEM OBJECTIVES ENGINERING PLAN MANUFACTURING PLAN PRODUCTION TOOLING PLAN ASSEMBLY PLAN ASSEMBLY TOOLING PLAN SP BUILD MRD CP BUILD MRD •		

70

fig-5

COMPONENT OBJECTIVES

DATE:

COMPONENT

MODELS	PLANNING VOLUMES	PLANNING YEAR
SEDAN COUPE UP-LEVEL BASE LEVEL •		

OBJECTIVES	TARGETS	STATUS
BUSINESS VARIABLE COST INVESTMENT COST • • •		
TECHNICAL MATERIAL MASS PERFORMANCE RELIABLITY QUALITY ASM PROCESSING & TOOLING MFG PROCESSING & TOOLING • • •		
TIMING SYSTEM OBJECTIVES ENGINERING PLAN STYLING APPROVAL SURFACE RELEASE DEVELOPMENT/VALIDATION PLAN MANUFACTURING/ SUPPLIER PLAN GAGE/FIXTURE PLAN PRODUCTION TOOLING PLAN ASSEMBLY PLAN ASSEMBLY TOOLING PLAN SP BUILD MRD CP BUILD MRD ISIR PLAN •		

74

Fig-6

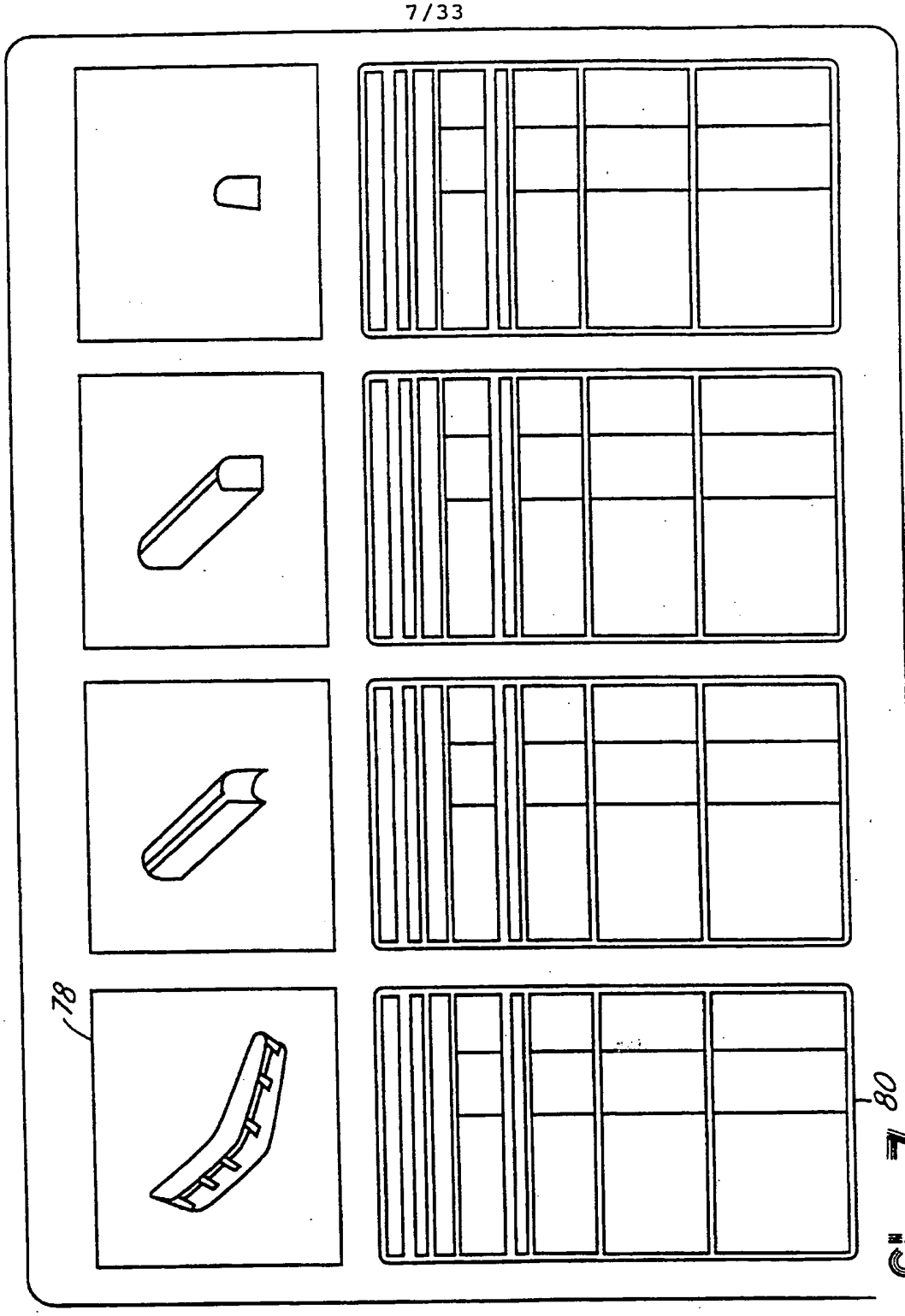


FIG. 7

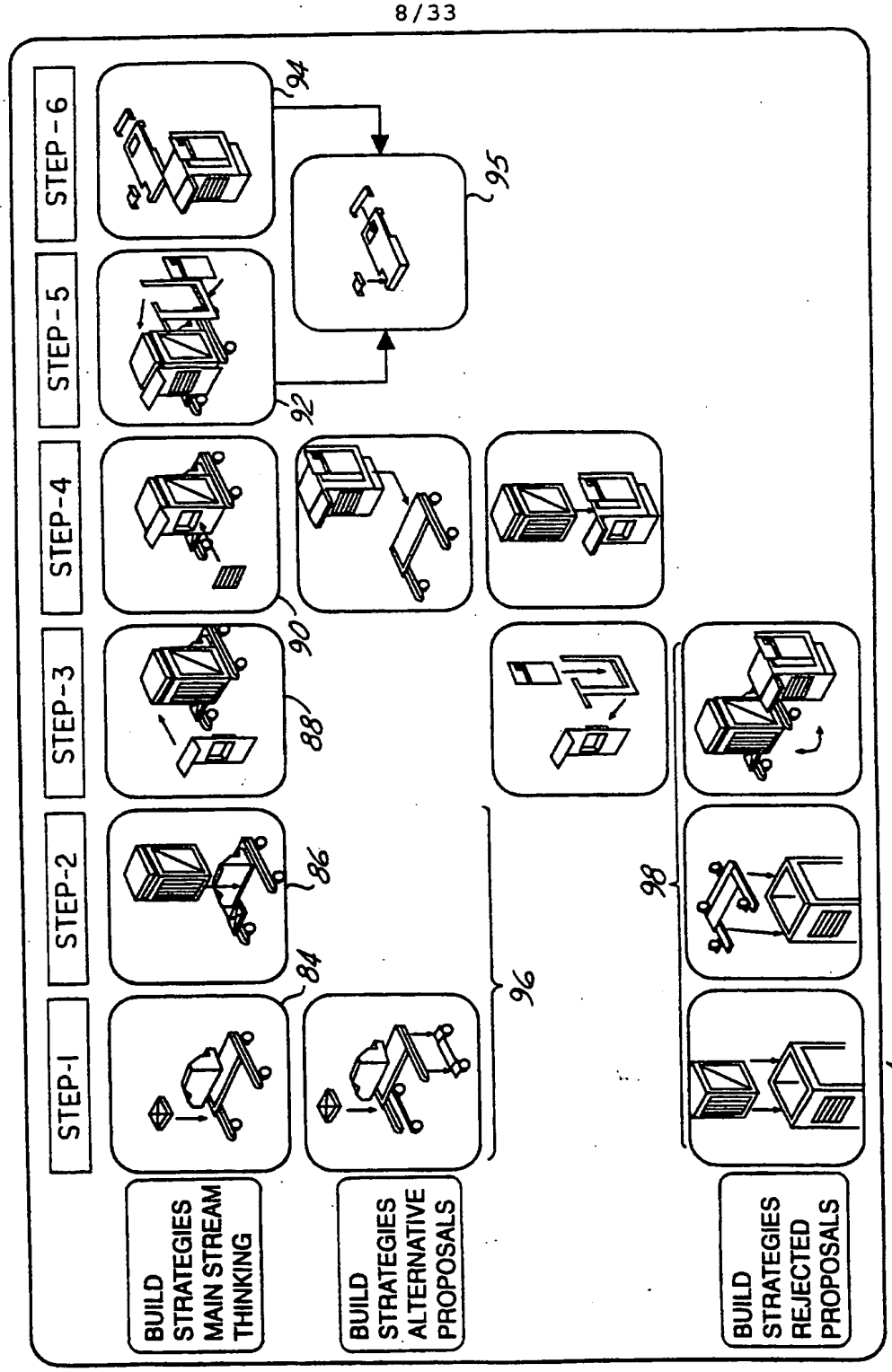

STEP-1
STEP-2
STEP-3
STEP-4
STEP-5
STEP-6
BUILD STRATEGIES MAIN STREAM THINKING
BUILD STRATEGIES ALTERNATIVE PROPOSALS
BUILD STRATEGIES REJECTED PROPOSALS
84
86
88
90
92
94
95
96
98
82

fig-8

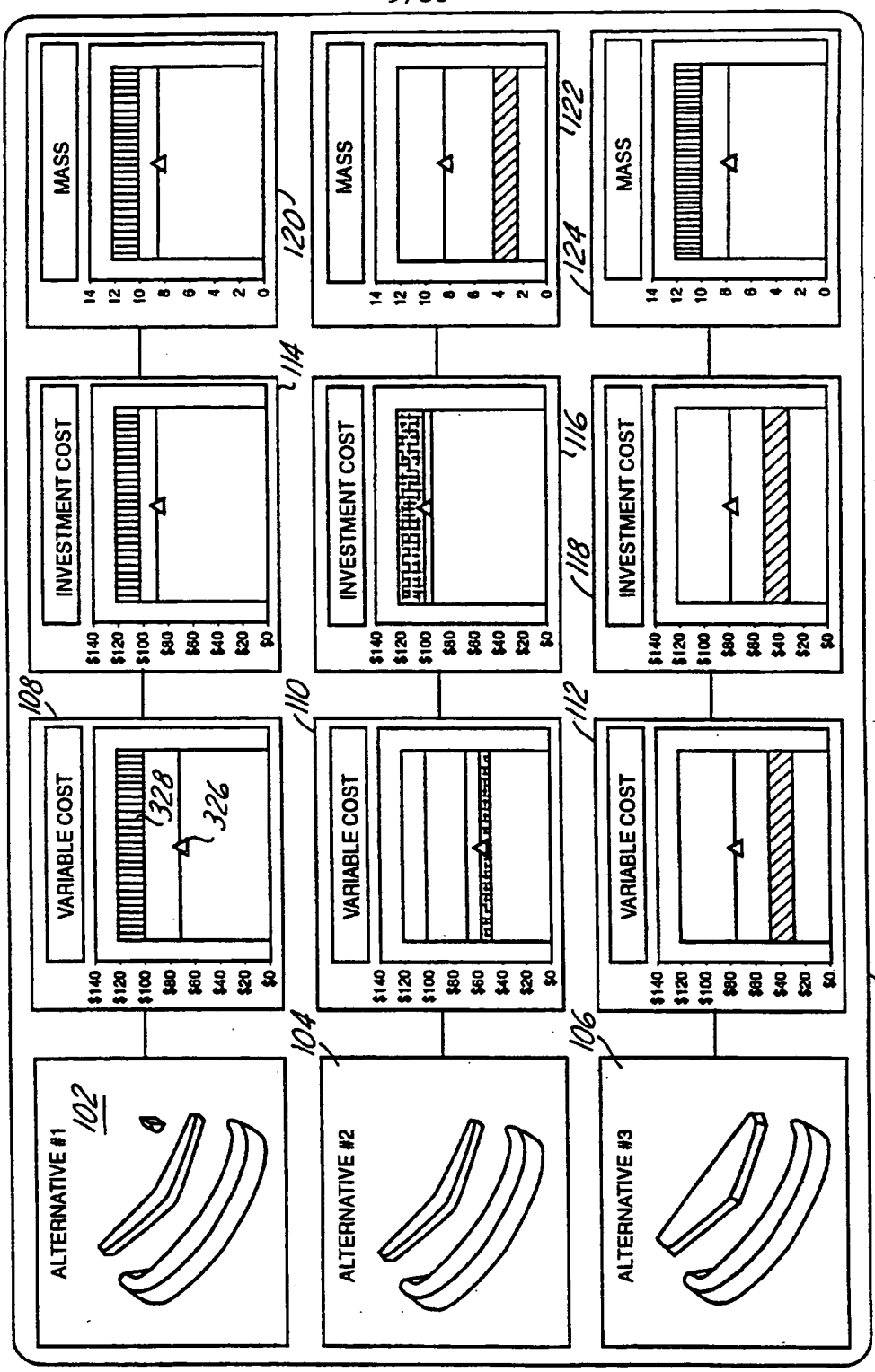

ALTERNATIVE #1
102
ALTERNATIVE #2
ALTERNATIVE #3
VARIABLE COST
INVESTMENT COST
MASS
328
326
104
106
108
110
112
114
116
118
120
122
124
100

Fig-9

INTERFACE/INTEGRATION OBJECTIVES

DATE:

SYSTEMS

MODELS	PLANNING VOLUMES	PLANNING YEAR
SEDAN COUPE UP-LEVEL BASE LEVEL •		

OBJECTIVES	TARGETS	STATUS
FIT & FINISH INTERFACE BUMPER TO FENDER BUMPER TO GOP BUMPER TO LAMPS HEADLAMP SIDE MARKER LAMP TURN SIGNAL LAMP • •		
FUNCTION INTEGRATION STRUCTURAL LOAD REQUIREMENTS ENERGY MANAGEMENT REQMTS. • • •		
TIMING BODY STRUCTURE DATA BODY EXTERIOR DATA • • •		

126

Fig-10

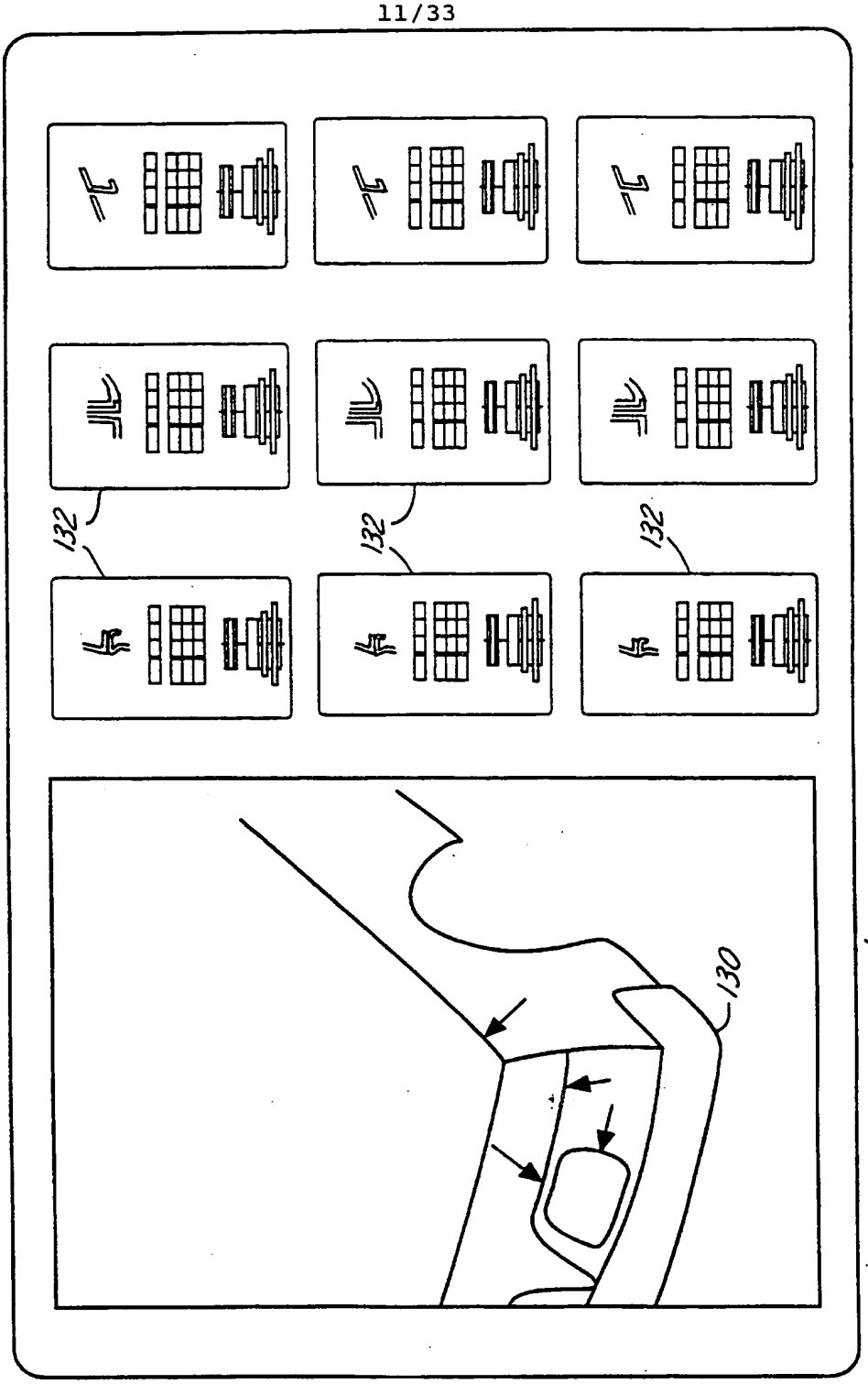
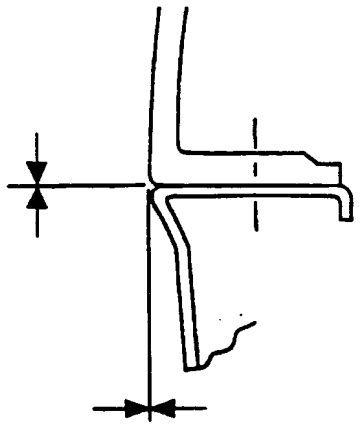


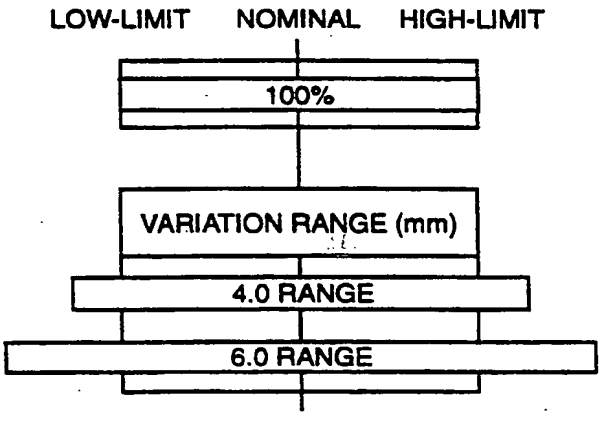
Fig-11



FENDER TO
FASCIA GAP

OBJECTIVE	-0.5	1.0	2.5

LOCATION	LOW	MEAN	HIGH
PT 1	-1.0	1.0	3.0
PT 2	-2.0	1.0	4.0



132

Fig-12

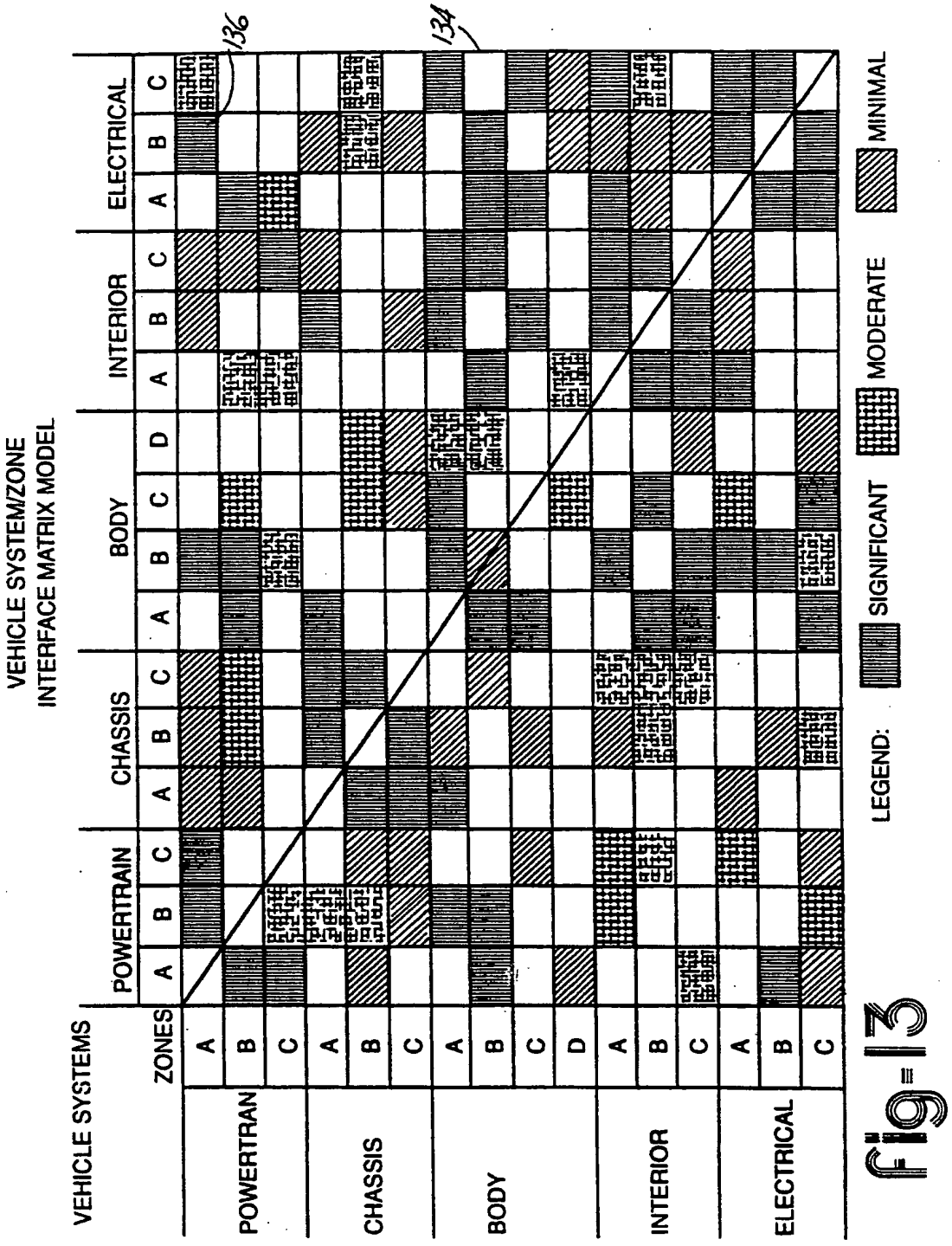

VEHICLE SYSTEM/ZONE
INTERFACE MATRIX MODEL
VEHICLE SYSTEMS
ZONES
POWERTRAIN
CHASSIS
BODY
INTERIOR
ELECTRICAL
A
B
C
D
136
134
LEGEND:
SIGNIFICANT
MODERATE
MINIMAL

Fig-13

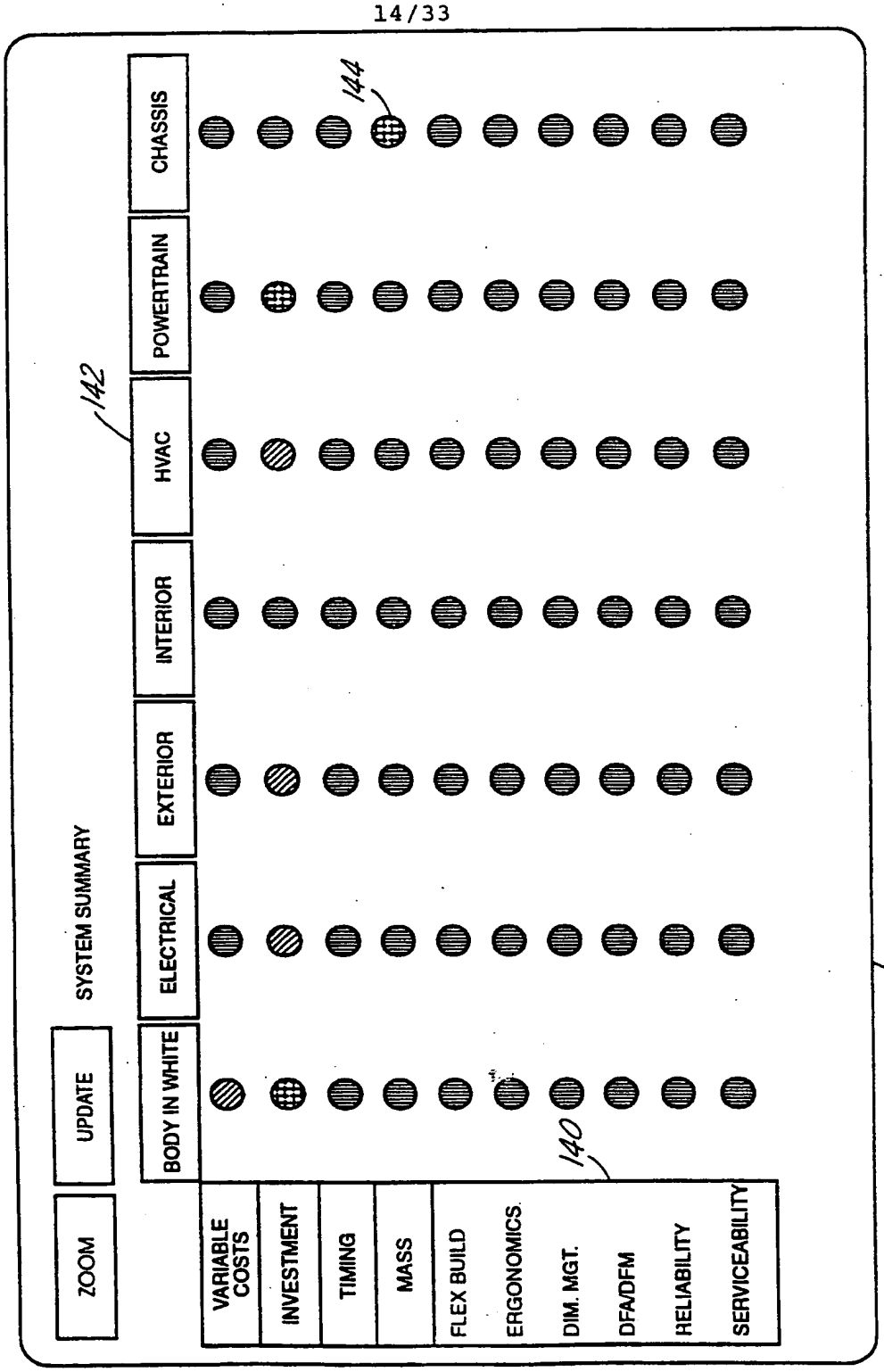

ZOOM
UPDATE
SYSTEM SUMMARY
BODY IN WHITE
ELECTRICAL
EXTERIOR
INTERIOR
HVAC
POWERTRAIN
CHASSIS
VARIABLE COSTS
INVESTMENT
TIMING
MASS
FLEX BUILD
ERGONOMICS
DIM. MGT.
DFA/DFM
RELIABILITY
SERVICEABILITY
138
140
142
144

Fig-14

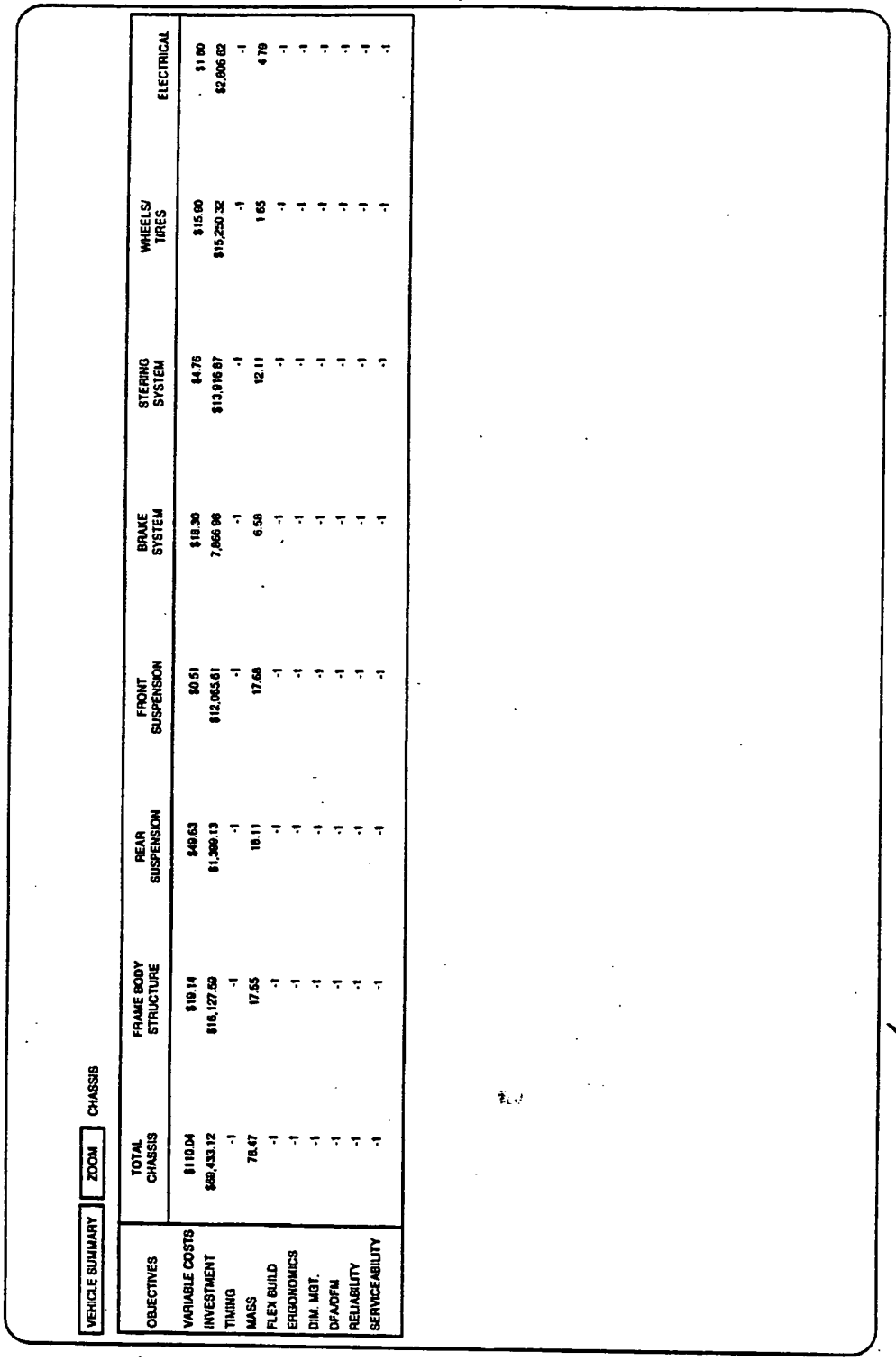

VEHICLE SUMMARY
ZOOM
CHASSIS
OBJECTIVES
TOTAL CHASSIS
FRAME BODY STRUCTURE
REAR SUSPENSION
FRONT SUSPENSION
BRAKE SYSTEM
STERING SYSTEM
WHEELS/ TIRES
ELECTRICAL
VARIABLE COSTS $110.04 $18.14 $49.63 $0.51 $18.30 $4.76 $15.00 $1.80
INVESTMENT $68,433.12 $18,127.59 $1,369.13 $12,065.61 7,866.98 $13,916.87 $15,250.32 $2,606.62
TIMING -1 -1 -1 -1 -1 -1 -1 -1
MASS 78.47 17.55 18.11 17.68 6.58 12.11 1.65 4.79
FLEX BUILD -1 -1 -1 -1 -1 -1 -1 -1
ERGONOMICS -1 -1 -1 -1 -1 -1 -1 -1
DIM. MGT. -1 -1 -1 -1 -1 -1 -1 -1
DFA/DFM -1 -1 -1 -1 -1 -1 -1 -1
RELIABILITY -1 -1 -1 -1 -1 -1 -1 -1
SERVICEABILITY -1 -1 -1 -1 -1 -1 -1 -1
146

Fig-15

VEHICLE SUMMARY | ZOOM | HVAC

OBJECTIVES	TOTAL HVAC	CLIMATE CONTROL MODULE	AIR INLET SYSTEM	REFIGERANT SYSTEM	HEATER HOSE SYSTEM	AIR DISTRIBUTION SYSTEM	CLIMATE CONTROL CONTROL SYSTEM
VARIABLE COSTS	$150.77	$9.31	$5.38	$43.66	$30.19	$40.68	$21.34
INVESTMENT	$66,659.93	$19,277.56	$3,410.92	$1,858.66	$7,703.41	$18,380.15	$16,229.32
TIMING	-1	-1	-1	-1	-1	-1	-1
MASS	51.77	2.98	1.34	10.61	9.91	11.46	15.28
FLEX BUILD	-1	-1	-1	-1	-1	-1	-1
ERGONOMICS	-1	-1	-1	-1	-1	-1	-1
DIM. MGT.	-1	-1	-1	-1	-1	-1	-1
DFA/DFM	-1	-1	-1	-1	-1	-1	-1
RELIABILITY	-1	-1	-1	-1	-1	-1	-1
SERVICEABILITY	-1	-1	-1	-1	-1	-1	-1

148

Fig-16

VEHICLE SUMMARY | ZOOM | POWERTRAIN

OBJECTIVES	TOTAL POWERTRAIN	ENGINE	EMMISION CONTROL SYSTEM	FUEL SYSTEM	TRANSMISSION	TRANSMISSION CONTROL SYSTEM	EXHAUST SYSTEM	COOLING SYSTEM	ENGINE CONTROL SYSTEM	ELECTRICAL
VARIABLE COSTS	$187.03	$26.55	$0.03	$2.75	$21.04	$5.77	$47.84	$22.06	$27.23	$33.75
INVESTMENT	$205,736.85	$29,203.67	$35.56	$3,030.47	$23,142.87	$6,351.92	$52,628.80	$24,269.43	$29,947.63	$37,126.21
TIMING	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
MASS	919.84	19.44	169.59	162.98	15.20	161.93	120.72	124.51	114.67	30.79
FLEX BUILD	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
ERGONOMICS	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DIM. MGT.	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DFA/DFM	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
RELIABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SERVICEABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

150

fig-17

VEHICLE SUMMARY | ZOOM | INTERIOR

OBJECTIVES	TOTAL INTERIOR	INTRUMENT PANEL	CONSOLE(S)	DOOR TRIM	SEAT ASSEMBLY(S)	UPPER SHELL TRIM	LOWER SHELL TRIM	ACOUSTICS	HEADLINER/ VISORS	CARPET	RESTRAINT SYSTEM	INTERIOR LIGHTING SYSTEM	ELECTRICAL
VARIABLE COSTS	$303.83	$31.61	$9.33	$28.92	$49.74	$33.05	$44.96	$2.31	$8.39	$12.96	$16.25	$40.49	$23.84
INVESTMENT	$107,124.58	$6,105.37	$5,695.20	$10,879.10	$5,168.76	$9,387.74	$19,148.59	$4,356.97	$9,862.24	$10,639.13	$10,473.29	$7,815.00	$7,583.10
TIMING	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
MASS	136.06	2.11	6.06	9.70	10.96	19.50	19.52	5.91	17.56	6.79	16.13	5.93	13.87
FLEX BUILD	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
ERGONOMICS	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DIM. MGT.	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DFA/DFM	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
RELIABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SERVICEABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

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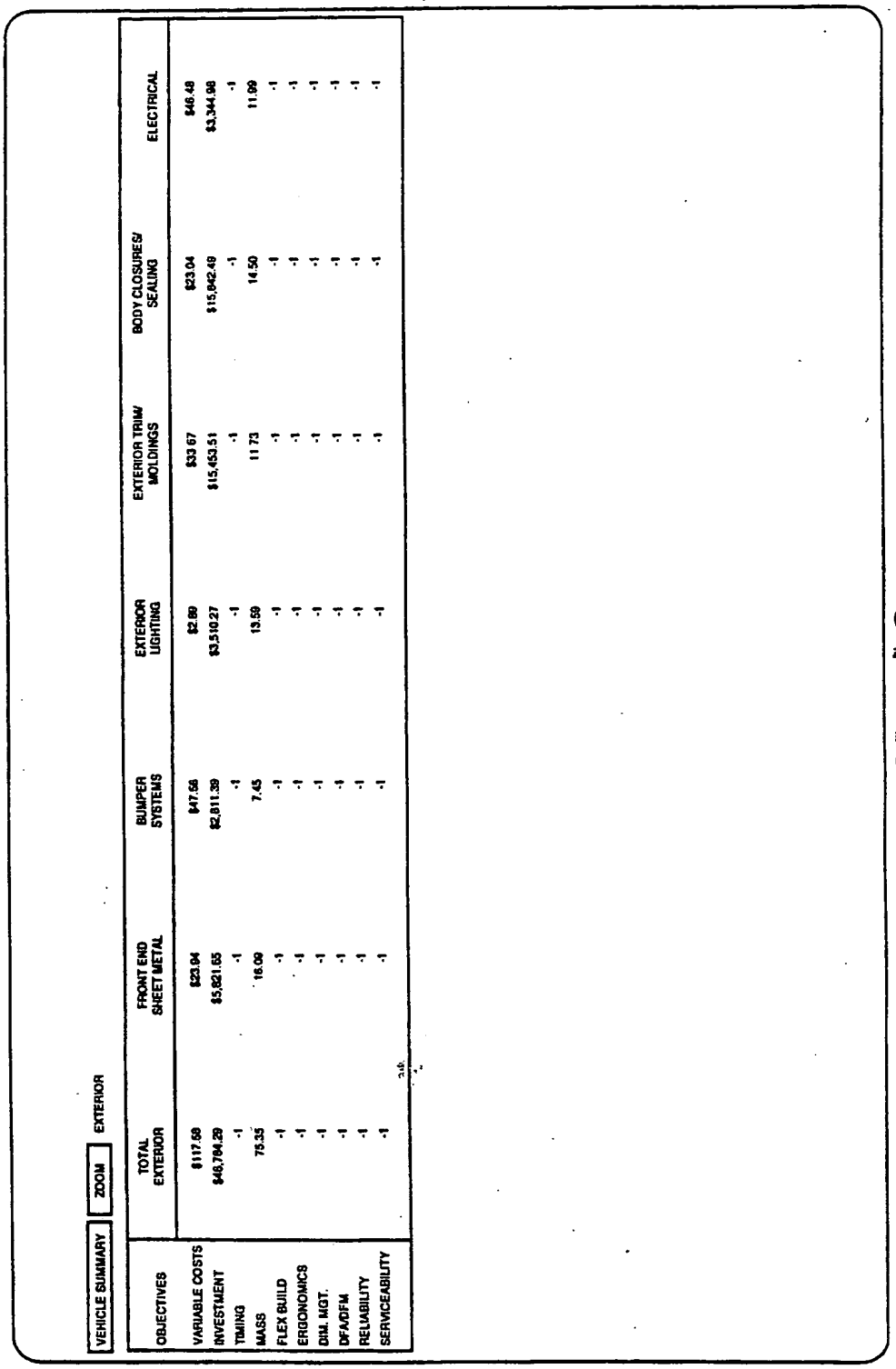
Fig-18



OBJECTIVES	TOTAL EXTERIOR	FRONT END SHEET METAL	BUMPER SYSTEMS	EXTERIOR LIGHTING	EXTERIOR TRIM/ MOLDINGS	BODY CLOSURES/ SEALING	ELECTRICAL
VARIABLE COSTS	$117.68	$23.04	$47.56	$2.89	$33.67	$23.04	$46.48
INVESTMENT	$46,784.29	$5,821.65	$2,811.39	$3,510.27	$15,453.51	$15,842.49	$3,344.98
TIMING	-1	-1	-1	-1	-1	-1	-1
MASS	75.35	16.09	7.45	13.59	11.73	14.50	11.99
FLEX BUILD	-1	-1	-1	-1	-1	-1	-1
ERGONOMICS	-1	-1	-1	-1	-1	-1	-1
DIM. MGT.	-1	-1	-1	-1	-1	-1	-1
DFA/DFM	-1	-1	-1	-1	-1	-1	-1
RELIABILITY	-1	-1	-1	-1	-1	-1	-1
SERVICEABILITY	-1	-1	-1	-1	-1	-1	-1

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Fig-19

VEHICLE SUMMARY | ZOOM | ELECTRICAL

OBJECTIVES	TOTAL ELECTRICAL	ENTERTAINMENT SYSTEM	FRONT END WIRING SYSTEMS	FRONT OF DASH WIRING SYSTEM	I/P WIRING SYSTEM	BODY WIRING SYSTEM	REAR END WIRING SYSTEMS	ELECTRICAL CONTROL MODULES	ACUTATORS	RELAYS	SOLENOIDS
VARIABLE COSTS	$273.25	$9.41	$40.25	$39.85	$20.52	$39.42	$48.39	$24.23	$26.30	$15.86	$9.03
INVESTMENT	$113,373.04	$10,194.32	$17,564.80	$19,230.36	$11,320.33	$19,004.06	$5,793.74	$12,522.83	$14,773.57	$2,481.94	$487.08
TIMING	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
MASS	97.21	15.98	2.89	16.23	17.29	8.98	2.97	17.58	1.07	8.75	7.40
FLEX BUILD	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
ERGONOMICS	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DIM. MGT.	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DFA/DFM	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
RELIABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SERVICEABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

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Fig-20

VEHICLE SUMMARY | ZOOM | BODY IN WHITE

OBJECTIVES	TOTAL BIW	UNDERBODY	FRONT END STRUCTURE	FRONT OF DASH	DOOR STRUCTURE	SIDE SILLS	HINGE PILLARS	ROOF	QUARTER	REAR END PANEL	DECK LID	GLASS SYSTEM	HARDWARE SYSTEM	WIPER SYSTEM	ELECTRICAL
VARIABLE COSTS	$310.76	$26.55	$0.03	$2.75	$21.04	$5.77	$47.84	$22.06	$27.23	$0.35	$20.80	$7.34	$48.79	$46.44	$33.75
INVESTMENT	$341,835.49	$29,203.67	$35.56	$3,030.47	$23,142.67	$6,351.92	$52,628.80	$24,269.43	$29,947.93	$386.46	$22,882.75	$8,071.86	$53,671.10	$51,086.49	$37,126.21
TIMING	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
MASS	1527.99	112.32	42.37	25.14	98.48	46.90	119.58	145.17	131.06	184.41	142.69	50.95	173.60	177.98	77.32
FLEX BUILD	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
ERGONOMICS	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DIM. MGT.	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
DFA/DFM	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
RELIABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
SERVICEABILITY	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1

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Fig-21

VEHICLE SUMMARY | ZOOM | GRAPHS | VARIABLE COSTS DETAIL

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TARGETS	$375.00	$230.00	$36.70	$76.30	$40.00	$90.00	$80.00	
DATE	BODY IN WHITE	ELECTRICAL	EXTERIOR	INTERIOR	HVAC	POWERTRAIN	CHASSIS	TOTAL
01/04/93	$116.53	$34.38	$26.38	$39.53	$36.71	$99.05	$104.09	$456.67
01/11/93	$84.55	$46.23	$24.93	$34.81	$35.63	$52.10	$189.95	$468.20
01/18/93	$146.84	$21.67	$25.31	$19.79	$38.43	$81.95	$102.84	$436.82
01/25/93	$123.61	$27.75	$31.02	$5.09	$30.08	$87.75	$69.19	$374.49
02/01/93	$143.38	$28.74	$14.10	$53.75	$34.45	$39.75	$43.34	$357.51
02/08/93	$104.54	$44.22	$15.15	$28.87	$37.98	$41.69	$23.97	$296.42
02/15/93	$66.27	$18.02	$29.01	$13.87	$44.18	$46.26	$142.38	$360.00
02/22/93	$69.33	$16.84	$30.71	$62.28	$43.32	$41.19	$85.15	$348.81
03/01/93	$92.64	$43.33	$38.36	$16.49	$34.04	$53.45	$163.64	$441.95
03/08/93	$127.16	$34.66	$12.49	$47.21	$46.51	$129.14	$92.95	$490.12
03/15/93	$123.10	$48.53	$13.71	$28.12	$48.74	$ 56.39	$92.66	$411.23
03/22/93	$141.90	$35.28	$12.92	$42.57	$30.62	$129.04	$72.00	$464.34
03/29/93	$119.15	$20.70	$31.18	$31.66	$42.51	$138.29	$11.87	$395.35
04/05/93	$119.61	$45.43	$18.35	$5.59	$47.63	$110.06	$206.27	$552.94
04/12/93	$140.77	$38.25	$12.66	$52.69	$40.37	$35.47	$175.56	$495.77
04/19/93	$96.02	$36.60	$35.29	$62.99	$34.66	$131.94	$14.13	$411.63
04/26/93	$83.84	$39.05	$37.09	$45.67	$29.38	$22.38	$84.91	$342.32
05/03/93	$124.07	$25.68	$26.65	$12.30	$20.24	$110.08	$123.30	$442.32
05/10/93	$117.71	$43.53	$21.67	$60.24	$29.86	$116.61	$162.95	$552.58
05/17/93	$61.37	$35.57	$27.99	$13.07	$30.57	$40.49	$45.90	$254.97
05/24/93	$122.65	$27.84	$33.14	$57.42	$46.69	$123.86	$29.62	$441.22
05/31/93	$57.73	$20.80	$23.79	$18.12	$25.75	$104.83	$153.41	$404.44
06/07/93	$127.38	$41.94	$29.01	$5.92	$20.50	$42.95	$176.71	$444.41
06/14/93	$142.64	$38.19	$33.66	$44.83	$46.03	$55.34	$51.70	$412.41
06/21/93	$146.52	$47.76	$18.84	$48.33	$48.97	$110.84	$42.89	$464.16
06/28/93	$112.78	$32.43	$18.66	$26.34	$28.07	$39.93	$155.99	$414.20
07/05/93	$118.19	$37.31	$15.46	$37.40	$38.06	$127.61	$88.71	$462.73
07/12/93	$119.52	$41.73	$27.47	$12.82	$41.19	$107.10	$65.90	$415.73
07/19/93	$141.39	$45.78	$16.23	$52.29	$43.26	$101.46	$71.59	$471.99
07/26/93	$56.40	$18.46	$12.69	$22.73	$43.61	$71.00	$140.40	$365.29
08/02/93	$113.59	$24.71	$14.30	$74.82	$40.83	$53.72	$120.82	$442.79
08/09/93	$146.68	$34.72	$37.07	$34.06	$28.70	$96.40	$72.87	$450.50
08/16/93	$68.19	$30.09	$39.84	$15.71	$29.08	$63.84	$12.59	$259.34
08/23/93	$130.79	$33.02	$29.78	$45.57	$21.26	$83.66	$66.03	$410.13
08/30/93	$112.02	$25.48	$21.31	$20.85	$39.58	$74.39	$44.93	$338.57
09/06/93	$53.83	$31.90	$22.62	$68.08	$43.72	$133.86	$206.99	$561.01
09/13/93	$62.86	$35.14	$36.70	$7.50	$28.46	$56.09	$112.77	$339.54
09/20/93	$53.12	$16.52	$26.33	$45.66	$22.44	$53.59	$42.23	$259.88
09/27/93	$86.92	$17.19	$24.78	$40.63	$37.60	$52.77	$182.91	$442.80
10/04/93	$145.65	$39.31	$26.77	$56.92	$23.91	$60.12	$152.63	$505.29
10/11/93	$136.34	$16.65	$36.35	$9.07	$25.94	$106.36	$169.01	$499.73
10/18/93	$115.59	$40.59	$11.24	$26.25	$41.05	$46.34	$128.40	$409.47
10/25/93	$86.72	$38.67	$35.49	$71.83	$30.67	$81.96	$206.63	$531.96
11/01/93	$101.82	$19.20	$24.68	$65.10	$49.42	$45.78	$144.17	$450.16
11/08/93	$74.57	$26.56	$30.81	$54.32	$28.55	$92.76	$128.18	$435.75
11/15/93	$85.38	$28.12	$15.94	$43.15	$33.49	$97.57	$133.91	$437.57
11/22/93	$134.86	$49.99	$26.71	$34.61	$37.07	$25.10	$137.96	$446.30
11/29/93	$77.03	$30.09	$14.01	$69.66	$42.90	$111.49	$165.98	$511.16
12/06/93	$138.48	$38.08	$34.62	$19.66	$35.81	$103.42	$87.15	$457.21
12/13/93	$104.69	$33.25	$34.31	$64.63	$38.68	$92.91	$18.12	$386.60
12/20/93	$129.77	$37.50	$24.23	$41.61	$37.58	$75.30	$148.79	$494.79
12/27/93	$100.97	$16.75	$14.91	$30.12	$39.52	$127.86	$152.45	$482.59

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Fig-22

VEHICLE SUMMARY | ZOOM | GRAPHS | INVESTMENT DETAIL

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TARGETS	$340,000	$150,000	$50,000	$100,000	$120,000	$200,000	$30,000	
DATE	BODY IN WHITE	ELECTRICAL	EXTERIOR	INTERIOR	HVAC	POWERTRAIN	CHASSIS	TOTAL
01/04/93	$323,242	$80,531	$58,539	$113,646	$68,592	$217,492	$13,478	$875,520
01/11/93	$347,288	$105,640	$51,196	$108,439	$86,812	$186,190	$26,715	$912,280
01/18/93	$352,888	$94,756	$63,177	$91,730	$54,745	$203,382	$18,609	$879,287
01/25/93	$359,089	$113,178	$37,498	$117,705	$80,351	$187,106	$48,350	$943,276
02/01/93	$352,271	$112,006	$58,273	$92,388	$53,602	$208,932	$14,897	$892,368
02/08/93	$342,520	$116,526	$68,634	$87,548	$76,301	$185,239	$39,350	$916,119
02/15/93	$344,418	$97,605	$65,274	$100,849	$80,378	$216,114	$36,995	$941,632
02/22/93	$322,191	$114,982	$62,339	$112,889	$60,524	$206,137	$28,699	$907,761
03/01/93	$331,751	$94,913	$37,225	$103,597	$73,746	$209,536	$44,201	$894,968
03/08/93	$322,088	$114,717	$60,722	$80,524	$68,252	$212,219	$19,757	$878,279
03/15/93	$382,566	$96,665	$44,051	$81,491	$74,252	$ 213,182	$42,686	$880,892
03/22/93	$340,568	$83,779	$45,266	$104,126	$79,096	$217,785	$45,259	$915,878
03/29/93	$356,036	$99,970	$67,545	$104,766	$59,319	$185,411	$40,497	$913,545
04/05/93	$325,366	$107,088	$31,833	$119,242	$72,039	$204,004	$22,314	$881,886
04/12/93	$357,206	$81,312	$36,382	$108,031	$58,243	$193,960	$42,556	$877,692
04/19/93	$348,593	$101,442	$45,655	$118,294	$80,441	$193,925	$47,405	$935,754
04/26/93	$352,000	$91,549	$61,107	$105,271	$67,197	$190,937	$45,661	$913,722
05/03/93	$341,731	$90,513	$56,342	$105,578	$87,037	$207,468	$11,393	$900,062
05/10/93	$352,213	$110,918	$69,144	$84,845	$84,227	$187,825	$33,482	$922,654
05/17/93	$350,641	$119,848	$32,879	$92,266	$78,935	$216,432	$14,512	$905,513
05/24/93	$356,519	$104,027	$39,786	$104,487	$64,256	$190,485	$11,566	$871,127
05/31/93	$350,557	$91,868	$38,624	$91,405	$62,620	$219,488	$21,371	$875,934
06/07/93	$345,463	$114,861	$39,209	$106,308	$74,079	$214,151	$42,337	$936,407
06/14/93	$341,088	$80,870	$46,314	$112,918	$78,952	$197,181	$35,955	$893,278
06/21/93	$356,468	$81,779	$55,458	$91,790	$87,368	$218,432	$40,090	$931,384
06/28/93	$321,219	$88,028	$33,056	$118,600	$58,164	$186,936	$36,623	$842,625
07/05/93	$358,830	$92,515	$33,455	$96,793	$59,672	$202,312	$45,996	$889,573
07/12/93	$344,308	$116,386	$35,335	$97,124	$74,867	$198,048	$31,109	$897,177
07/19/93	$328,721	$119,179	$69,997	$86,553	$83,411	$219,152	$23,105	$930,117
07/26/93	$333,091	$85,887	$44,011	$99,037	$83,045	$206,690	$31,523	$883,263
08/02/93	$324,189	$113,255	$48,755	$90,678	$62,882	$191,685	$11,336	$842,779
08/09/93	$334,677	$108,268	$59,317	$111,760	$51,056	$190,908	$29,349	$885,334
08/16/93	$320,154	$100,602	$35,278	$98,152	$69,258	$207,020	$42,487	$872,952
08/23/93	$335,550	$82,261	$65,863	$94,591	$56,636	$205,623	$10,446	$850,971
08/30/93	$323,415	$116,455	$31,985	$112,336	$55,585	$211,643	$15,230	$866,649
09/06/93	$356,569	$88,393	$47,635	$93,701	$61,893	$217,634	$10,049	$875,873
09/13/93	$327,642	$100,424	$53,175	$85,962	$51,785	$186,413	$10,112	$815,513
09/20/93	$347,969	$104,085	$42,990	$117,138	$88,313	$180,611	$47,768	$928,874
09/27/93	$348,383	$111,492	$40,020	$96,141	$79,655	$201,563	$44,553	$921,807
10/04/93	$324,359	$118,634	$39,663	$89,822	$71,755	$190,101	$22,586	$856,921
10/11/93	$338,060	$103,019	$55,566	$119,358	$67,866	$191,703	$27,853	$903,425
10/18/93	$339,724	$88,213	$69,765	$88,551	$77,452	$198,528	$47,863	$910,096
10/25/93	$340,968	$97,740	$39,734	$86,471	$86,967	$210,818	$36,182	$898,881
11/01/93	$342,423	$90,868	$64,778	$98,998	$75,013	$210,187	$26,333	$906,601
11/08/93	$328,282	$82,763	$44,323	$97,715	$64,378	$207,267	$27,587	$852,314
11/15/93	$350,190	$81,521	$30,563	$80,707	$73,426	$196,250	$25,107	$837,764
11/22/93	$353,046	$104,573	$68,004	$117,699	$59,396	$198,784	$38,990	$938,491
11/29/93	$345,136	$86,969	$62,354	$102,102	$56,046	$209,765	$10,667	$873,039
12/06/93	$345,184	$84,030	$51,322	$110,408	$58,193	$207,479	$11,188	$867,804
12/13/93	$328,743	$80,884	$39,760	$115,480	$75,611	$180,652	$23,873	$845,003
12/20/93	$346,490	$111,368	$31,702	$94,201	$88,817	$194,837	$43,853	$911,267
12/27/93	$336,871	$98,812	$41,765	$82,012	$69,228	$190,709	$34,961	$854,359

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Fig-23

VEHICLE SUMMARY | ZOOM | GRAPHS | TIMING DETAIL 168

NUMBERS INDICATE NUMBER OF WEEKS EARLY TO SCHEDULE.
NEGATIVE NUMBERS INDICATE SLIPPAGE.

TARGETS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
DATE	BODY IN WHITE	ELECTRICAL	EXTERIOR	INTERIOR	HVAC	POWERTRAIN	CHASSIS	AVERAGE
01/04/93	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00	-3.00
01/11/93	-2.00	-2.00	-2.00	-3.00	-2.00	-2.00	-3.00	-2.29
01/18/93	-2.00	-2.00	-2.00	-2.00	-2.00	-1.00	-3.00	-2.00
01/25/93	-2.00	-1.00	-2.00	-1.00	-1.00	-1.00	-3.00	-1.57
02/01/93	-2.00	-1.00	-2.00	-1.00	-1.00	0.00	-2.00	-1.29
02/08/93	-2.00	-1.00	-2.00	-1.00	-1.00	0.00	-2.00	-1.29
02/15/93	-2.00	-1.00	-2.00	-1.00	-1.00	0.00	-2.00	-1.29
02/22/93	-2.00	0.00	-1.00	-1.00	0.00	0.00	-2.00	-0.86
03/01/93	-1.00	0.00	-1.00	-1.00	0.00	0.00	-1.00	-0.57
03/08/93	-1.00	0.00	0.00	0.00	0.00	1.00	-1.00	-0.14
03/15/93	-1.00	0.00	0.00	0.00	0.00	1.00	-1.00	-0.14
03/22/93	-1.00	0.00	0.00	0.00	0.00	1.00	-1.00	-0.14
03/29/93	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.14
04/05/93	0.00	1.00	0.00	0.00	1.00	2.00	1.00	0.71
04/12/93	1.00	1.00	0.00	0.00	2.00	2.00	1.00	1.00
04/19/93	1.00	1.00	0.00	1.00	3.00	2.00	2.00	1.43
04/26/93	1.00	2.00	1.00	1.00	3.00	2.00	2.00	1.71
05/03/93	1.00	2.00	1.00	1.00	3.00	2.00	2.00	1.71
05/10/93	2.00	2.00	1.00	1.00	3.00	2.00	3.00	2.00
05/17/93	3.00	2.00	1.00	1.00	4.00	3.00	3.00	2.43
05/24/93	3.00	2.00	1.00	1.00	5.00	3.00	4.00	2.71
05/31/93	3.00	2.00	2.00	1.00	5.00	4.00	4.00	3.00
06/07/93	4.00	2.00	2.00	2.00	5.00	4.00	4.00	3.29
06/14/93	4.00	3.00	3.00	2.00	5.00	5.00	5.00	3.86
06/21/93	4.00	3.00	3.00	2.00	5.00	5.00	5.00	3.86
06/28/93	5.00	4.00	4.00	2.00	5.00	6.00	6.00	4.57
07/05/93	5.00	4.00	5.00	3.00	6.00	6.00	6.00	5.00
07/12/93	6.00	4.00	5.00	3.00	6.00	6.00	7.00	5.29
07/19/93	7.00	4.00	5.00	3.00	7.00	7.00	7.00	5.71
07/26/93	8.00	5.00	5.00	3.00	7.00	8.00	8.00	6.29
08/02/93	8.00	6.00	5.00	4.00	8.00	8.00	9.00	6.86
08/09/93	8.00	7.00	5.00	4.00	8.00	9.00	10.00	7.29
08/16/93	9.00	7.00	5.00	4.00	8.00	9.00	11.00	7.57
08/23/93	10.00	8.00	5.00	4.00	8.00	9.00	12.00	8.00
08/30/93	10.00	9.00	5.00	4.00	8.00	9.00	13.00	8.29
09/06/93	10.00	9.00	6.00	4.00	8.00	9.00	13.00	8.43
09/13/93	10.00	9.00	6.00	5.00	9.00	10.00	13.00	8.86
09/20/93	10.00	10.00	6.00	6.00	9.00	10.00	13.00	9.14
09/27/93	10.00	10.00	7.00	6.00	9.00	10.00	14.00	9.43
10/04/93	10.00	10.00	8.00	6.00	9.00	11.00	14.00	9.71
10/11/93	11.00	11.00	8.00	6.00	9.00	11.00	14.00	10.00
10/18/93	11.00	11.00	8.00	6.00	9.00	12.00	14.00	10.14
10/25/93	12.00	11.00	8.00	6.00	9.00	13.00	14.00	10.43
11/01/93	12.00	11.00	8.00	6.00	9.00	13.00	15.00	10.57
11/08/93	12.00	11.00	8.00	7.00	9.00	14.00	16.00	11.00
11/15/93	13.00	12.00	8.00	7.00	9.00	14.00	16.00	11.29
11/22/93	13.00	12.00	8.00	7.00	9.00	14.00	16.00	11.29
11/29/93	13.00	12.00	8.00	7.00	9.00	15.00	16.00	11.43
12/06/93	14.00	12.00	8.00	8.00	10.00	15.00	16.00	11.86
12/13/93	15.00	12.00	8.00	8.00	10.00	16.00	16.00	12.14
12/20/93	15.00	12.00	8.00	8.00	10.00	16.00	16.00	12.14
12/27/93	15.00	12.00	8.00	8.00	10.00	16.00	17.00	12.29

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Fig-24

VEHICLE SUMMARY | ZOOM | GRAPHS | MASS DETAIL

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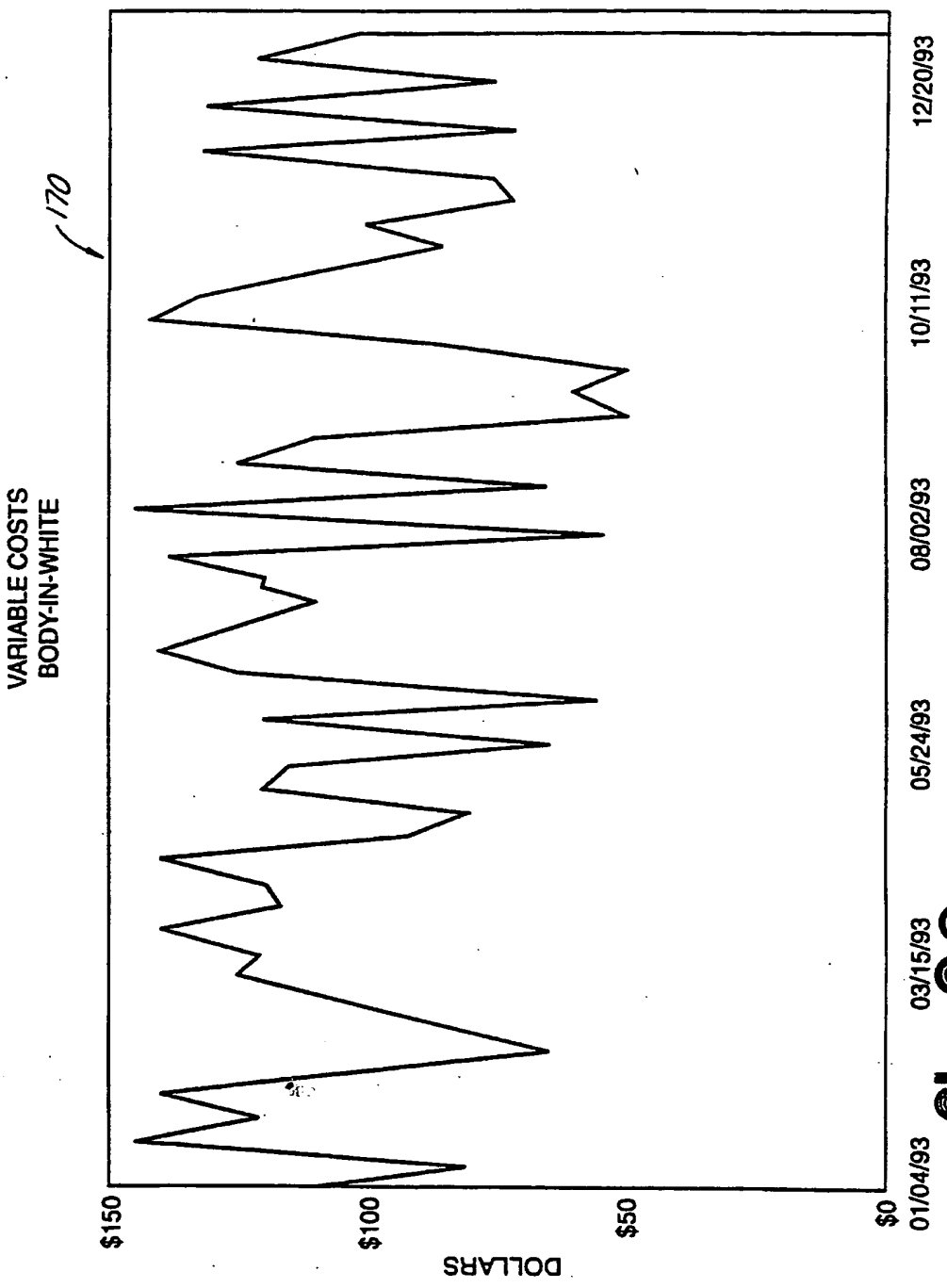
TARGETS	101.12	34.50	36.70	76.30	40.00	90.00	80.00	
DATE	BODY IN WHITE	ELECTRICAL	EXTERIOR	INTERIOR	HVAC	POWERTRAIN	CHASSIS	TOTAL
01/04/93	116.53	34.38	26.38	39.53	36.71	99.05	104.09	456.67
01/11/93	84.55	46.23	24.93	34.81	35.63	52.10	189.95	468.20
01/18/93	146.84	21.67	25.31	19.79	38.43	81.95	102.84	436.82
01/25/93	123.61	27.75	31.02	5.09	30.08	87.75	69.19	374.49
02/01/93	143.38	28.74	14.10	53.75	34.45	39.75	43.34	357.51
02/08/93	104.54	44.22	15.15	28.87	37.98	41.69	23.97	296.42
02/15/93	66.27	18.02	29.01	13.87	44.18	46.26	142.38	360.00
02/22/93	69.33	16.84	30.71	62.28	43.32	41.19	85.15	348.81
03/01/93	92.84	43.33	38.36	16.49	34.04	53.45	163.64	441.95
03/08/93	127.16	34.66	12.49	47.21	46.51	129.14	92.95	490.12
03/15/93	123.10	48.53	13.71	28.12	48.74	56.39	92.66	411.23
03/22/93	141.90	35.28	12.92	42.57	30.62	129.04	72.00	464.34
03/29/93	119.15	20.70	31.18	31.66	42.51	138.29	11.87	395.35
04/05/93	119.61	45.43	18.35	5.59	47.63	110.06	206.27	552.94
04/12/93	140.77	38.25	12.66	52.69	40.37	35.47	175.56	495.77
04/19/93	96.02	36.60	35.29	62.99	34.66	131.94	14.13	411.63
04/26/93	83.84	39.05	37.09	45.67	29.38	22.38	84.91	342.32
05/03/93	124.07	25.68	26.65	12.30	20.24	110.08	123.30	442.32
05/10/93	117.71	43.53	21.67	60.24	29.86	116.61	162.95	552.58
05/17/93	61.37	35.57	27.99	13.07	30.57	40.49	45.90	254.97
05/24/93	122.65	27.84	33.14	57.42	46.69	123.86	29.62	441.22
05/31/93	57.73	20.80	23.79	18.12	25.75	104.83	153.41	404.44
06/07/93	127.38	41.94	29.01	5.92	20.50	$42.95	176.71	444.41
06/14/93	142.64	38.19	33.66	44.83	46.03	55.34	51.70	412.41
06/21/93	146.52	47.76	18.84	48.33	48.97	110.84	42.89	464.16
06/28/93	112.78	32.43	18.66	$26.34	28.07	$39.93	155.99	414.20
07/05/93	118.19	37.31	15.46	37.40	38.06	127.61	88.71	462.73
07/12/93	119.52	41.73	27.47	12.82	41.19	107.10	65.90	415.73
07/19/93	141.39	45.78	16.23	52.29	43.26	101.46	71.59	471.99
07/26/93	56.40	18.46	12.69	22.73	43.61	71.00	140.40	365.29
08/02/93	113.59	24.71	14.30	74.82	40.83	53.72	120.82	442.79
08/09/93	146.68	34.72	37.07	34.06	28.70	96.40	72.87	450.50
08/16/93	68.19	30.09	39.84	15.71	29.08	63.84	12.59	259.34
08/23/93	130.79	33.02	29.78	45.57	21.26	83.68	66.03	410.13
08/30/93	112.02	25.48	21.31	20.85	39.58	74.39	44.93	338.57
09/06/93	53.83	31.90	22.62	68.08	43.72	133.86	206.99	561.01
09/13/93	62.86	35.14	36.70	7.50	28.46	56.09	112.77	339.54
09/20/93	53.12	16.52	26.33	45.66	22.44	53.59	42.23	259.88
09/27/93	86.92	17.19	24.78	40.63	37.60	52.77	182.91	442.80
10/04/93	145.65	39.31	26.77	56.92	23.91	60.12	152.63	505.29
10/11/93	136.34	16.65	36.35	9.07	25.94	106.36	169.01	499.73
10/18/93	115.59	40.59	11.24	26.25	41.05	46.34	128.40	409.47
10/25/93	86.72	38.67	35.49	71.83	30.67	61.96	206.63	531.96
11/01/93	101.82	19.20	24.68	65.10	49.42	45.78	144.17	450.16
11/08/93	74.57	26.56	30.81	54.32	28.55	92.76	128.18	435.75
11/15/93	85.38	28.12	15.94	43.15	33.49	97.57	133.91	437.57
11/22/93	134.86	49.99	26.71	34.61	37.07	25.10	137.96	446.30
11/29/93	77.03	30.09	14.01	69.66	42.90	111.49	165.98	511.16
12/06/93	138.48	38.08	34.62	19.66	35.81	103.42	87.15	457.21
12/13/93	104.69	33.25	34.31	64.63	38.68	92.91	18.12	386.60
12/20/93	129.77	37.50	24.23	41.61	37.58	75.30	148.79	494.79
12/27/93	100.97	16.75	14.91	30.12	39.52	127.86	152.45	482.59

166A

Fig-25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$50
$0
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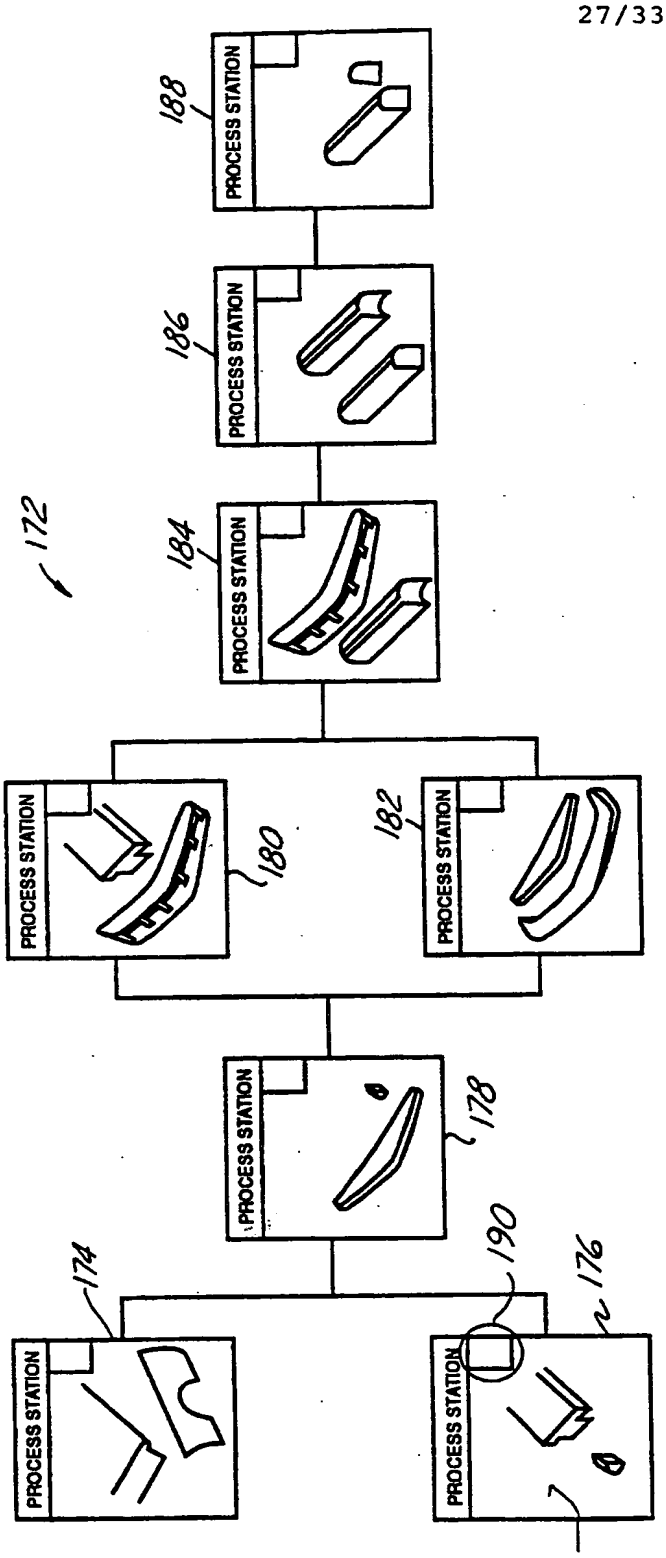
01/04/93
03/15/93
05/24/93
08/02/93
10/11/93
12/20/93
DATE

Fig-26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PROCESS STATION
174
176
178
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182
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188
190

Fig-27

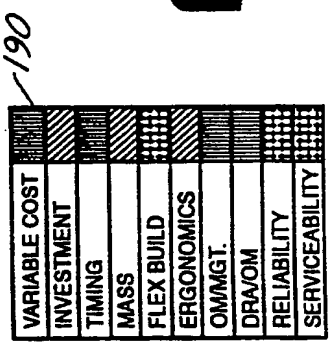

190
VARIABLE COST
INVESTMENT
TIMING
MASS
FLEX BUILD
ERGONOMICS
OMMGT.
DRA/OM
RELIABILITY
SERVICEABILITY

Fig-28

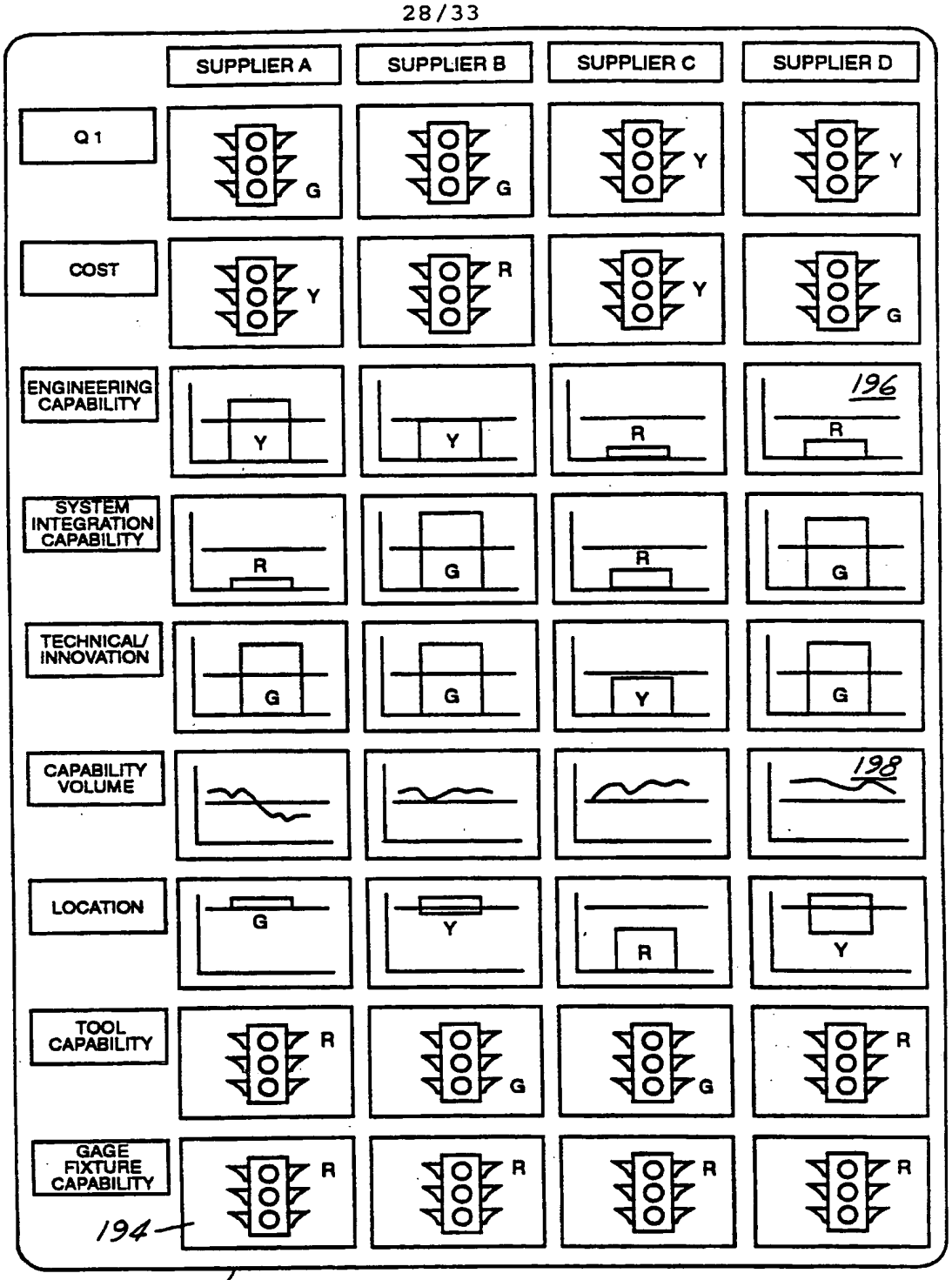

SUPPLIER A
SUPPLIER B
SUPPLIER C
SUPPLIER D
Q1
COST
ENGINEERING CAPABILITY
SYSTEM INTEGRATION CAPABILITY
TECHNICAL/ INNOVATION
CAPABILITY VOLUME
LOCATION
TOOL CAPABILITY
GAGE FIXTURE CAPABILITY
G
Y
R
196
198
194
192

Fig-29

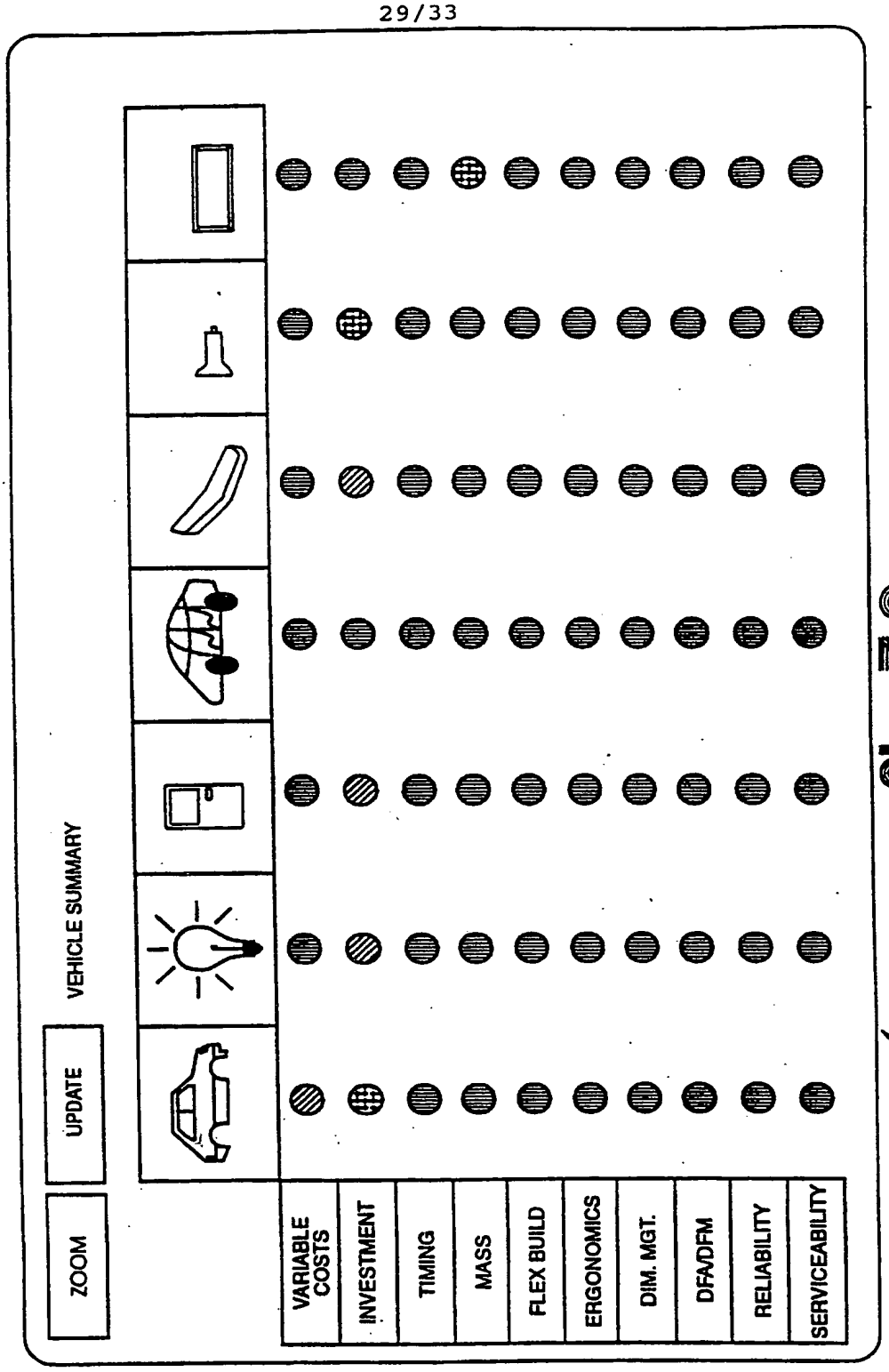
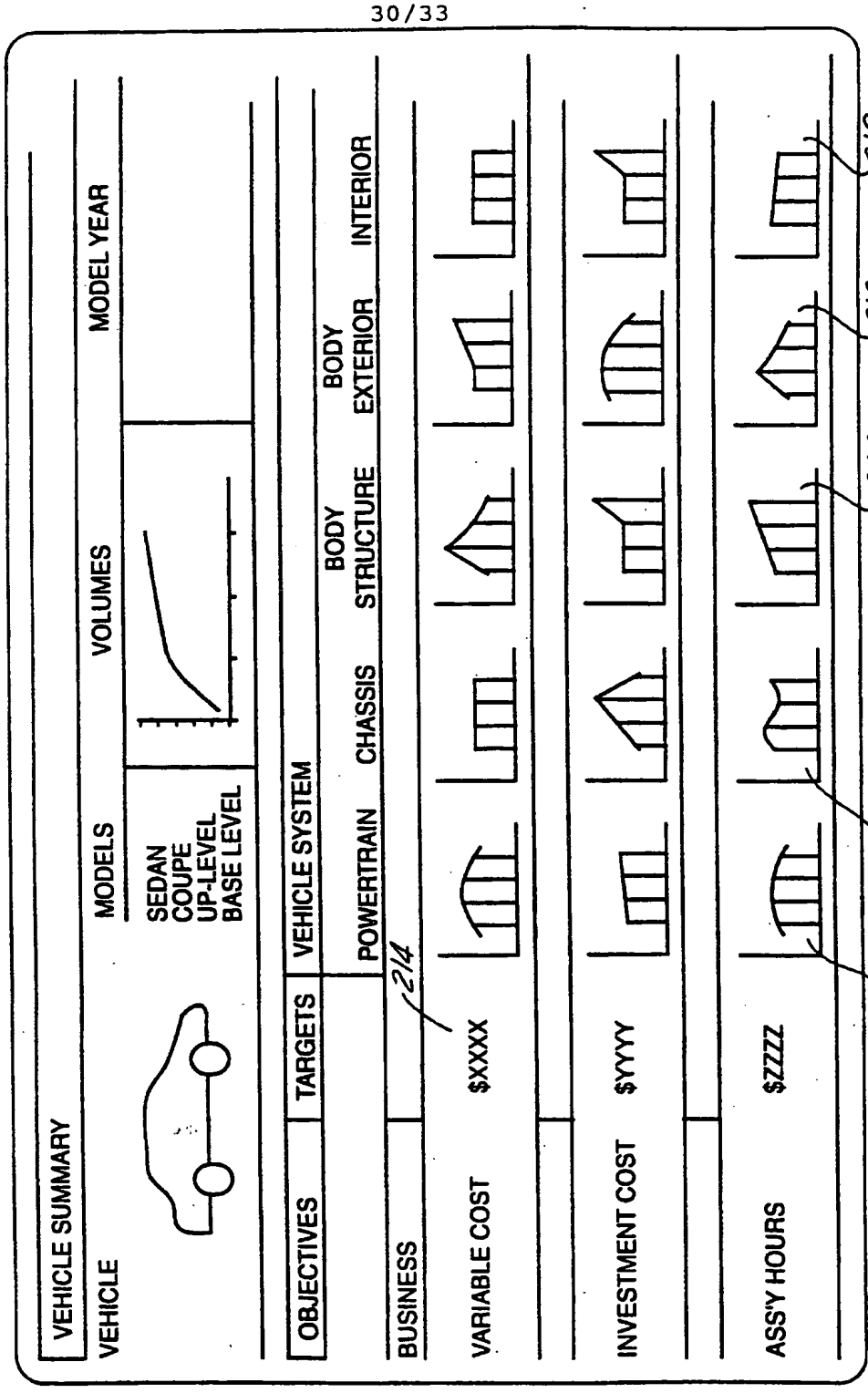

ZOOM
UPDATE
VEHICLE SUMMARY
VARIABLE COSTS
INVESTMENT
TIMING
MASS
FLEX BUILD
ERGONOMICS
DIM. MGT.
DFA/DFM
RELIABILITY
SERVICEABILITY
200

fig-30


VEHICLE SUMMARY
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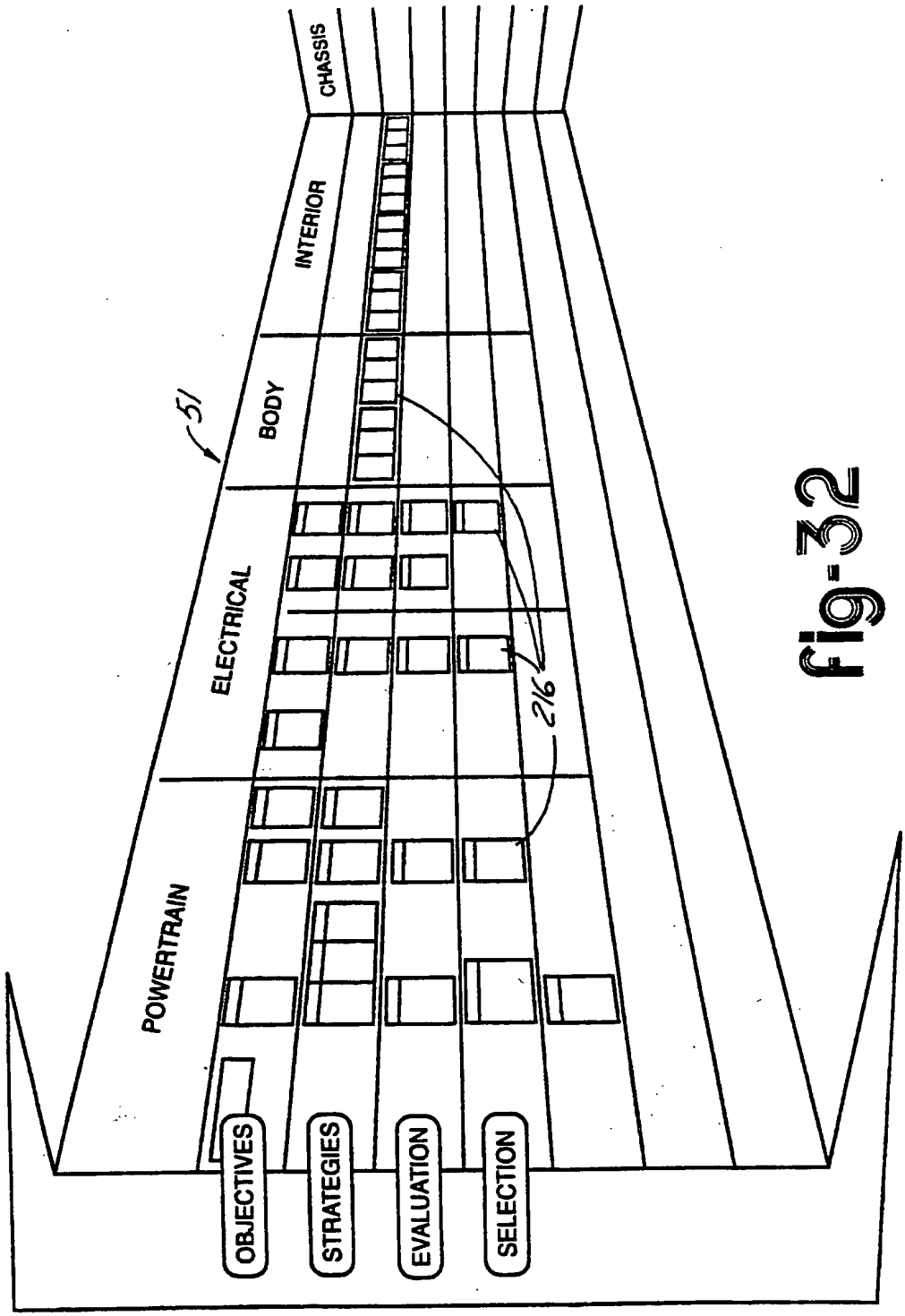
MODELS
SEDAN
COUPE
UP-LEVEL
BASE LEVEL
VOLUMES
MODEL YEAR
OBJECTIVES
TARGETS
VEHICLE SYSTEM
POWERTRAIN
CHASSIS
BODY STRUCTURE
BODY EXTERIOR
INTERIOR
BUSINESS
214
VARIABLE COST
$XXXX
INVESTMENT COST
$YYYY
ASS'Y HOURS
$ZZZZ
202
204
206
208
210
212

Fig-3


CHASSIS
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BODY
ELECTRICAL
POWERTRAIN
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216
OBJECTIVES
STRATEGIES
EVALUATION
SELECTION

fig-32

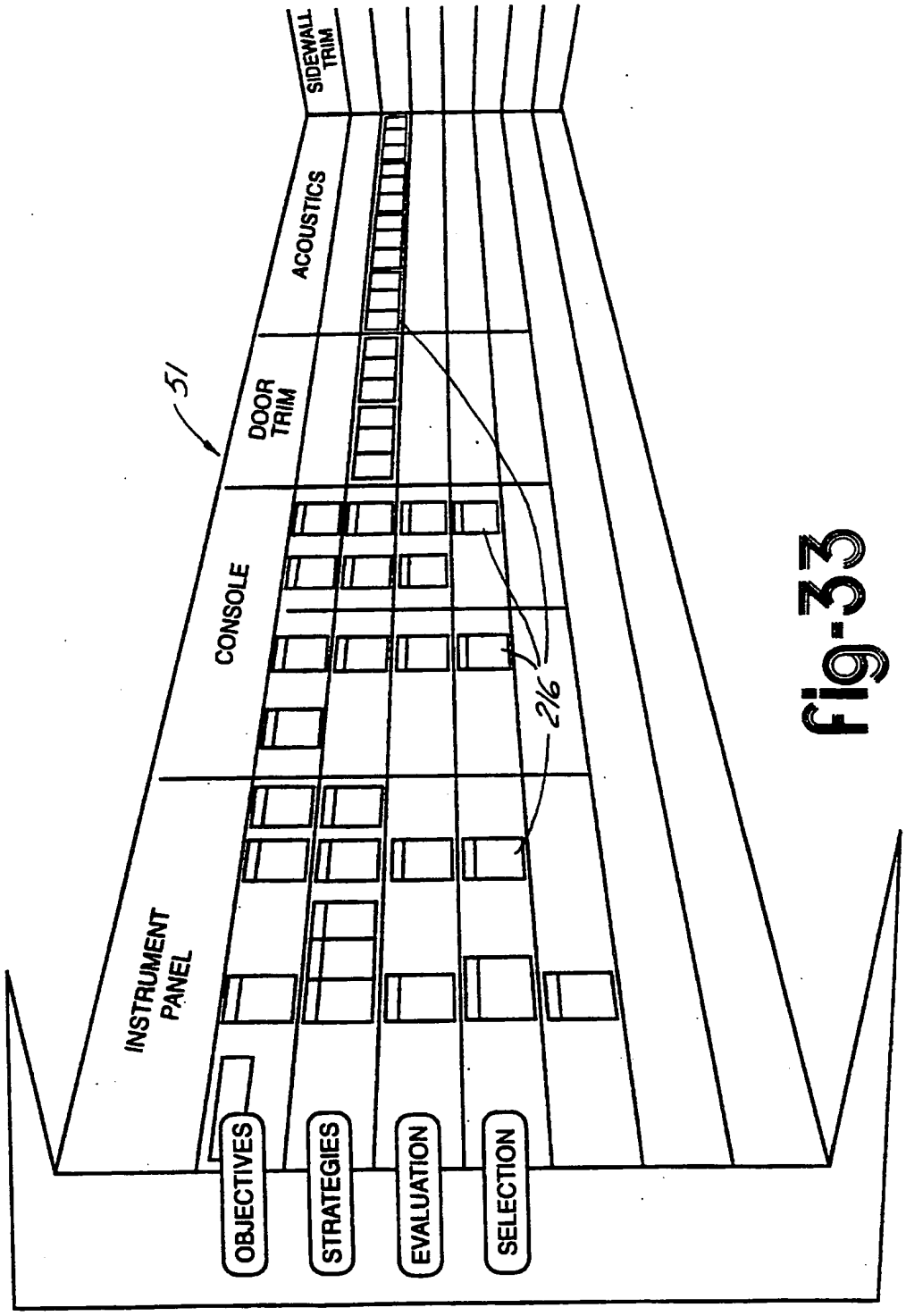
SIDEWALL TRIM
ACOUSTICS
DOOR TRIM
CONSOLE
INSTRUMENT PANEL
51
216
OBJECTIVES
STRATEGIES
EVALUATION
SELECTION

Fig-33

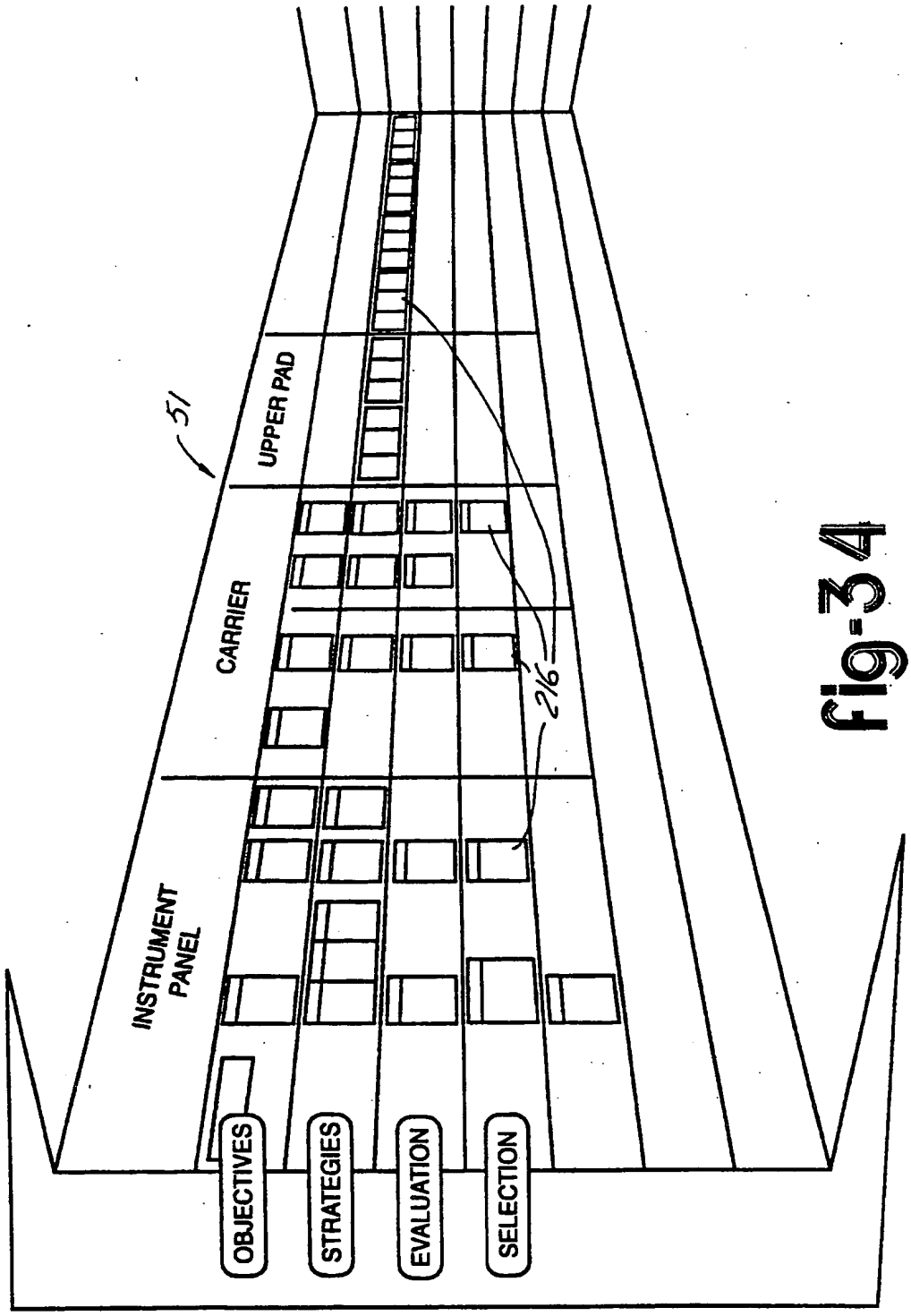
51
UPPER PAD
CARRIER
INSTRUMENT PANEL
216
OBJECTIVES
STRATEGIES
EVALUATION
SELECTION

fig-34

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/01893

A. CLASSIFICATION OF SUBJECT MATTER
IPC(5) :G06F 15/46, 15/24.
US CL :364/401, 468.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 364/401, 468.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, P	US, A, 5,212,791 (Damian et al.) 18 May 1993. See the entire document.	1-11
Y,P	US, A, 5,195,041 (George et al.) 16 March 1993. See the entire document.	1-11
Y	US, A, 5,193,143 (Kaemmerer et al.) 09 March 1993. See the entire document.	1-11
X -- Y	US, A, 5,193,065 (Gueindon et al.) 09 March 1993. See ABSTRACT; Figs. 2 and 3; col. 3, line 29 - col. 9, line 28.	1 --- 2-11
A	US, A, 5,182,705 (Barr et al.) 26 January 1993. See the entire document.	1-11

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
13 MAY 1994

Date of mailing of the international search report
MAY 31 1994

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. N/A

Authorized officer
Xuong M. Chung-Trans
Telephone No. (703) 305-9772

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/01893

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,128,860 (Chapman) 07 July 1992. See ABSTRACT; Fig. 2; and col. 2, line 9 - col. 6, line 60.	1-11
X	US, A, 5,089,970 (Lee et al.) 18 February 1992. See ABSTRACT; Figs. 2, 4, 6, 15, 26-28; col. 3, line 60 - col. 6, line 22.	1-11
Y	US, A, 5,056,028 (Ohta et al.) 08 October 1991. See the entire document.	1-11
X	US, A, 5,050,088 (Buckler et al.) 17 September 1991. See ABSTRACT; col. 1, lines 35-62; col. 7, line 1 - col. 8, line 50; col. 10, line 46 - col. 21, line 48.	1-11
X	US, A, 5006,990 (Ward et al.) 09 April 1991. See ABSTRACT; col. 1, line 22 - col. 3, line 4; col. 5, line 2 - col. 31, line 60.	1-11
Y	US, A, 4,887,218 (Natarajan) 12 December 1989. See the entire document.	1-11
X	US, A, 4,875,162 (Ferriter et al.) 17 October 1989. See col. 1, line 24 - col. 3, line 66; col. 10, line 8 - col. 12, line 26.	1-11
X	US, A, 4,827,423 (Beasley et al.) 02 May 1989. See the entire document.	1-11
Y	US, A, 4,718,025 (Minor et al.) 05 January 1988. See ABSTRACT; Figs. 1-2, 6, 10 and 20.	1-11